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The Southland Convention

Seldom have the transactions of state or sectional conventions been marked with more fertile discussion than that which characterized the recent sessions of the Southeastern Section of the National Electric Light Association, held at Macon, Ga., Aug. 14 to 16, and reported elsewhere in this issue. The spirit of the new South was in evidence on every hand during the meetings. It was the younger generation of central-station men—keen, intelligent and alert—that was largely represented on the program and in the lively discussions provoked by the papers. And, without respect to longitude or clime, this is the type which makes the central-station office invariably the "bright spot" of its community and drafts into the company's policies the modern business decalogue. It is this subtle essence which, North and South, East and West, characterizes the central-station industry of to-day and finds its intangible expression in "square-deal" and "public-be-pleased" policies no less than in the material evidences of attractive display window, well-stocked showcase, and the electric vehicle at the curb. And the South has its share of these progressive legions, which are carrying it forward to an electrical and commercial development that is sure to surprise both the visitor from the conservative North and him from the West. Despite the baking temperature which prevailed during the Macon sessions, the recent Southeastern convention kept closely to business and took part in discussions which would have done much credit to a national convention. One simple expedient, adopted through the foresight of President Deal and his association co-workers, doubtless contributed considerably to the success of these meetings. This was the assignment of brief prepared discussions to a couple of members for each of the convention papers. Unlike the usual contributed efforts, these were purposely kept short, meaty and interesting. They were on hand in readiness to bridge over that curious and difficult psychological moment so generally experienced in conventions after the author has finished reading his paper and the presiding officer has called for discussion. Once started, there are usually plenty of subjects and plenty of members ready to enter into the discussion, and the valuable character of the matter thus brought out at Macon will be evident from a perusal of the accompanying report. The Southeastern Section of the N. E. L. A. is to be congratulated on its highly profitable inaugural convention. Although yet receiving its chief support from the former membership of the Georgia state association, a number of representatives of the other four states included in the geographic section were present for this first annual meeting. With one of the richest fields of central-station and transmission development to draw upon, it may be safely predicted that the future conventions of the section will be as significant in numbers as the recent sessions were successful in both technical discussion and fellowship.

The Condenser for Wave-Form Analysis

We publish in this issue an article by Dr. Frederick Bedell describing with charming simplicity an experimental method for determining the form of an alternating voltage or current. It consists in the use of a condenser, a D'Arsonval type of current measurer, and a synchronous commutator with brushes capable of accurate mechanical phase displacement. A sufficient number of successive measurements having been made, at corresponding phase positions, the form of the wave can be accurately delineated, ready for subsequent Fourier analysis if desired. An advantage of the plan is that when measuring a voltage there is no danger of a short-circuit at the brushes. The degree of precision attainable in this way should far exceed that ordinarily obtained with the oscillograph.

Labels for Station Apparatus

One of the great central-station management companies makes its stations distinctive and easily understood by the liberal use of labels on machines, switchboards, pipes, etc. The idea here is hardly, of course, that followed in a certain other plant in this country where each engine and turbine is entitled, in beautiful gold-leaf letters, "Martha" or "John," after favored namesakes in the officials' families. But labels can be legitimately used with advantage to facilitate more general understanding of the station apparatus and to decrease the element of error in operation. Especially is this true of switches and valves, where a number of identical pieces of equipment may confuse the attendant. It seems worth while to letter oil switches, for example, both as to their functions and also so as to mark each phase. In one plant the three-compartment switch groups are even divided off by broad red bands to avoid confusion and the danger of accidentally entering a live phase of an adjoining group. Pipes for the water, oil, steam, air and vacuum systems are all painted distinctive colors and are in addition labeled at outlet points. The labor and expense of keeping up such a system of marking are likely to be pretty heavy, with the changes continually going on in the average plant, and such a system, to be of any value whatsoever must of course be held accurately up to date. In an emergency, however, the trouble thus taken will pay for itself, for a properly labeled station need no longer depend altogether for its intelligent operation upon the few attendants who handle with familiarity the intricate equipment.

Surface Combustion

Considerable attention has recently been devoted to a type of flameless combustion which gives promise of an extended application. In the case of the familiar process of ordinary flame combustion a jet of gas enters into chemical combination with oxygen, at the external surface, in free air. If, for instance, the fuel is oil, this is carried up to the flame through the wick by capillary attraction. It is then vaporized, or gasified, at the top, within the flame. The hydrocarbon gases may be partially disassociated, if the flame is hot enough, just before entering the flame zone. This zone of flame is ordinarily a thin mantle, closely confined to the surface of union between the hydrocarbon gas within and the oxygen of the air without. The temperature of the flame tends to be lowered not only by the cooling action of the air washing its outer surface but also by that of the incoming relatively cool gas. That is, the temperature of any fuel flame is reduced somewhat by the relatively low temperatures of the fuel gases meeting in it. When the gas and air are separately prepared and are intermixed in the proper proportions, as when a jet of mixed coal-gas and air is fed through a tube like that of a Bunsen burner, a thicker layer of flame can be produced with a corresponding rise of temperature. Still higher flame temperatures can be obtained by heating the incoming gases and reducing the diluting nitrogen, and also by inclosing the flame in a refractory chamber. Curiously enough, a hot flame is not a good radiator of heat, and there is some difficulty in getting the heat out of it and into the substance which is required to be heated.

If a porous plate of refractory substance is fitted on one side with a close-fitting cup and supply pipe, and inflammable gas is driven through the plate outward from the cup, the gas issuing from the plate can be ignited, and the flame will cover the plate. If the right amount of air is now mixed with the gas in the cup, so as to produce an explosive mixture, the flame can be cut down to a mere surface film, the combustion occurring flamelessly inside the pores of the plate. The plate becomes thereby intensely heated, since all of the combustion of heat which previously was liberated at the surface of the enveloping gas flame is now liberated within the much smaller surface of the porous plate. The plate is thus able to radiate off a large proportion of the generated heat from the highly heated solid plate substance. It may be that the greatly increased luminous intensity of a gas burner produced by covering it with a Welsbach mantle and admitting air on the inside partly owes its effect to this phenomenon of flameless combustion.

If, instead of using a porous refractory plate, use be made of a metal pipe filled with coarse granules of fireclay, and the explosive mixture of gases be admitted through a fireclay plug at one end, there will similarly be an intense heating of the granules and a flameless combustion within their pores. The metal tube containing the flameless burner may then be placed in a boiler to produce steam, or in a tank to melt lead. The explosion of the entering mixed gases in the case of a porous plate is prevented by the chilling effect of the pores on the cool or admission side. In the case of coarse granules the speed of the entering gaseous jet can be made to exceed that at which flame can be propagated backward through an explosive mixture.

The method above briefly outlined is called the Bonecourt process, having been developed in England by Prof. W. A. Bone and Mr. C. D. McCourt. A description of the process appeared recently in the London *Electrician*. The evaporative power from a boiler heated by the Bonecourt process is stated to have reached 35.5 lb. of water from and at 100 deg. C. per hour per square foot of heating surface, representing an efficiency of 92.5 per cent. It is claimed that this high efficiency is attributable partly to the accuracy with which the admixture of air can be made to the entering fuel gas and partly to the low temperature of the emerging products of combustion—170 deg. C. being mentioned in one instance. Thus far the process is limited to gaseous fuel. That is to say, coal or oil, in order to be employed, must first be gasified. It was stated in *Metallurgical and Chemical Engineering* last July that substantially the same process had been discovered and patented in America by Prof. Charles E. Lucke, of Columbia University, some ten years ago, although it has only recently been applied commercially in this country.

Reconstruction of Existing Generating Stations

The problem of reconstructing old generating systems is rapidly coming to the front because consolidations and syndicate control, based as they are on economic considerations, call for centralized and modern generating stations. In a great many cases an entirely new station is erected, and where conditions admit of it an old station is enlarged or rehabilitated. Even when consolidations do not obtain, the increasing use of electricity in existing systems necessitates additions and betterments, and the desire for large industrial loads and intensive business is the incentive which prompts the installation of the most reliable and efficient apparatus. Otherwise progress in the industry would not be so rapid as it is. The extensive improvements made in steam and electrical machinery since most of the present central stations were erected, and the fact that these have passed the experimental stage, have also much to do with the tendency to scrap old equipment. A central-station company which has been in existence for from ten to fifteen years should have by this time written off or liquidated a large part of the original cost of machinery or established an amortization fund to assist in the purchase of modern apparatus. Certainly there are in many localities not connected to hydroelectric systems small steam stations, all obsolete and inefficient in character, which could advantageously be replaced by a single steam plant, and the station which is suitably located as regards coal and water supply should gradually absorb the loads of the other plants if properly manned and designed.

An excellent example of a reconstructed system is recorded elsewhere in this issue. The station carries both a lighting and a railway load and has a large ice-making plant as an adjunct. It therefore possesses greater possibilities for economy than the average station, and hence may not be considered typical. Nevertheless, the engineering problems involved do not differ from those of

other systems and the economies effected are also possible of attainment elsewhere. The writer is careful to point out the sources of trouble found in the old equipment, many of which were due to faulty design, and it is from examining this phase of the subject that much good can be obtained. By rectifying errors of this kind investment may be conserved and the day for scrapping equipment put off until a more favorable opportunity exists for making the substitution or for obtaining the necessary funds. Meanwhile some economy, even if not the maximum, may be realized. The old station at Hampton was not so bad as stations go, but that it was susceptible of much improvement is shown by the facts presented in the article printed in this issue. Great as are the economies effected by the change, the feat of substituting an entirely different type of prime mover and re-designing the condenser and piping system without interfering with the service may be considered greater. Only those who have had such work to do appreciate the immensity of the task as compared with the building of an entirely new station. Every precaution seems to have been taken to enable defective operation to be detected by records, and that high efficiency was aimed at is indicated by the care taken of the fresh water used in the station, none of which is permitted to go to waste.

Three-Phase Transformers

Several years ago one of the large central-station systems west of the Mississippi River introduced the use of pole-type three-phase transformers for supplying motor service to large customers. The manufacturers responded to the demand with special three-phase units designed for this company alone. Meanwhile the vogue of the three-phase transformer for distributing purposes spread to other cities, and recently pole-type three-phase units as large as 150 kw in rating were installed in a Western factory plant. The arguments for the use of single three-phase units instead of three standard single-phase transformers are chiefly academic. Obviously with three windings utilizing a single core and case the space occupied and the total weight are both less than for equivalent single-phase units, there being thus a saving in both first cost and transportation charges. As compared with these single-phase transformers, the three-phase transformer is more efficient. Those who have had to do with their maintenance and upkeep in the cities where extensive use has been made of three-phase units are strong advocates of the superiority of such three-phase equipment.

Heretofore, it must be emphasized, the application has been chiefly in the larger cities. For the small central station with limited stock facilities the use of three-phase units cannot be unqualifiedly recommended. In such cases flexibility is an important factor which must not be overlooked. Although, bought outright, the polyphase unit is cheaper, such economy is questionable in cases where one or two single-phase units will do the work for a long time to come. As the load later increases, three-phase distribution can be provided, using open-delta connection for the time being, if desirable. And although a three-phase transformer weighs less, it represents a single, bulky heavy unit considerably more difficult to hoist up to a cross-arm or platform than three single-phase units. The small central station manifestly cannot afford to carry in stock many reserve transformers of the various sizes needed, although if it is able to depend upon its regular single-phase equipment the matter of replacements becomes a simple problem. Here it is of the greatest importance that flexibility be attained even if at the sacrifice of minor technical advantages. And in turn the question of flexibility resolves itself into one of available reserve stock which can be carried. This is a function of the size of the company and, in general, of the population it serves. From the aspect of flexibility in making replacements, it seems evident that the small central station which is in any sense isolated from the large stock-distributing points should consider carefully all the points against as well as in favor of three-phase transformers.

British and American Street-Lighting Specifications

An interesting comparison of British and American street-lighting specifications appears in a recent issue of the London *Electrician*, as noted in this week's *Digest*. Attention is called to the specifications of the (British) Illuminating Society discussed on pages 966 and 999 of our issue dated May 10, 1913, and the recommendations of the National Electric Light Association outlined on page 1223 of our issue for June 7, 1913. For various reasons there is no general consensus of opinion either here or abroad regarding the proper method of rating lamps for street-lighting purposes. The German practice is to rate arc lamps in terms of mean lower hemispherical intensity, while the English preference is for the measurement of illumination as such, the basis being the projection on the horizontal plane 1 m above the pavement. The German practice in measuring illumination on the street is the same as the English. In America the N. E. L. A. committee proposes that the lamp to be used be thoroughly and clearly specified, employing well-authenticated conservative values representative of the performance of the lamp, that its equipment also be specified, and that reasonable limits be set for the variation of the lamp above and below the luminous power taken as standard.

There seems to be great doubt as to whether the average intensity or minimum intensity is the thing particularly to be specified, and also as to how far the uniformity of the lighting should be considered. The N. E. L. A. committee proceeds upon the theory that it is most desirable in the contract to draw up such a specification as to leave the minimum chance for misundersanding and for the difficulties that come from uncertainties of measurement. To this end it advises, first, the exact specification of the lamps that are going to be used and, second, the establishment of a suitable procedure for the verification of these lamps with respect to their adherence to the specification. Both the British and American proposals represent preliminary attempts at the solution of a difficult problem. We believe that the N. E. L. A. committee recommendation is along practical and rational lines and when followed out, as we trust it will be, will lead to sound and reasonable specifications on which street lighting may be based.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Illumination and School Hygiene

At a joint session of the Illuminating Engineering Society with the Fourth International Congress on School Hygiene to be held in the City Hall, Buffalo, N. Y., on Aug. 29 and 30, the following papers will be read and discussed:

"The Illumination Primer of the Illuminating Engineering Society," by Mr. E. L. Elliott; "The Relation of Illumination to Ocular Hygiene," by Dr. E. M. Alger; "The Efficiency of the Eye Under Different Systems of Lighting," by Prof. C. F. Ferree; "Glare from Paper," by Mr. M. Luckiesh; "Influence of Blackboard's Position on Lighting of Desks," by Dr. Mathilde G. Stettner; "Schoolhouse Lighting," by Dr. D. W. Weaver; "The Illumination of Class Rooms," by Dr. James Kerr; "Schoolhouse Lighting in General from the Standpoint of an Engineer," by Mr. B. B. Hatch; "Rural School Illumination," by Mr. W. L. Coffee, and "Testing Light in Schoolrooms," by Dr. George Fitz.

The chairman of the committee on arrangements for the joint session is Dr. Herbert E. Ives, 3101 Passyunk Avenue, Philadelphia, Pa., and the vice-chairman is Mr. W. R. Huntley, Electric Building, Buffalo, N. Y.

Work on Mexican Hydroelectric Project Halted by Government

Through the enforced cessation of construction work upon the dam across the Conchos River at La Boquillas, in the State of Chihuahua, there is danger of that project being destroyed by flood or revolutionists operating in that section. The dam is a part of a large hydroelectric and irrigation project which the Mexican Northern Power Company, a Canadian concern, has been striving to complete. Up to this time approximately $5,000,000 gold has been expended on work, and were it not for the harassment of bands of rebels from time to time and the difficulty of securing laborers the project would have been completed before this. A few days ago the chief engineer received imperative orders from General José Mercado, federal military governor of Chihuahua, to cease all construction work and to abandon the enterprise. At the time this order was received it is said there were about 6000 native laborers employed in the different branches of construction work. In its present unprotected state it is claimed that a flood in the Conchos might destroy the dam and cause the devastation of homes and property in the valleys of the Conchos and Rio Grande Rivers. Costly machinery is also left exposed to the elements and the hands of vandals. Mr. Fuller, the chief engineer, made his way to El Paso, Tex., after closing down construction operations. He disclaims that he has been aiding voluntarily either the rebels or the federals. It is said that General Mercado, acting on instructions from the federal government, stopped the work on the ground that the dam was interfering with the flow of the Conchos River. The action amounts to practically a nullification of the concessions which were granted to the Mexican Northern Power Company by the federal government during the Diaz régime and by the government of the State of Chihuahua.

The Mexican Northern Power Company is composed chiefly of Montreal and Toronto bankers. The plans call for an investment of more than $25,000,000. The dam across the Conchos River is only one feature of the project. The water impounded by that structure was to be used to irrigate approximately 200,000 acres of land in the valley of the river and to generate about 50,000 hp. The construction of an extensive system of canals and ditches is involved in the plans for reclaiming the 200,000 acres of land. From the hydroelectric plant transmission lines were to be built to the cities of Chihuahua, Parral, Jimenez, Santa Rosalia and a number of mining districts scattered about within a radius of 200 miles of La Boquillas.

Commonwealth Edison Absorbs Cosmopolitan Electric of Chicago

Official announcement was made on Aug. 14 of the consolidation of the Commonwealth Edison Company and the Cosmopolitan Electric Company of Chicago, which places the entire electric-service system of Chicago in the hands of one operating company. A special meeting has been called for Sept. 25 for the purpose of ratifying the plans of the consolidation. Provisions for increasing the capital stock of the company from $40,000,000 to $50,000,000 will also be made at that time.

Aside from the advantages resulting from the operation of the two properties by one organization, the Commonwealth Edison Company will acquire the fifty-year franchise granted in 1895 to the Cosmopolitan company. Although the franchise is a liberal one, including an electric railway line, the Cosmopolitan company has only supplied electricity in a limited territory and operated one car a day for the purpose of holding the railway franchise. The annual gross earnings of the Cosmopolitan company are nearly $1,000,000. The company was capitalized at $2,000,000 and has $2,000,000 in outstanding notes and a floating indebtedness of about $750,000. The latter will be wiped out through the process of the merger.

Progress Made by the Society for Electrical Development

A very largely attended and enthusiastic meeting of the board of directors of the Society for Electrical Development was held in New York City on Aug. 18. The feature of the meeting was the report of Mr. W. E. Robertson, chairman of the society's campaign committee, in which it was stated that applications had been received from more than 100 companies for membership since the last meeting of the board of directors, about a month ago. The membership at the present time is well over the 300 mark, and the amount of the subscriptions pledged to date is in excess of $134,000.

Mr. J. Robert Crouse handed to the chairman of the meeting, Mr. A. W. Burchard, twenty signed subscription blanks, amounting to $10,500, all of which had been recently secured by a special committee in the city of Cleveland.

The co-operative campaign undertaken by the Jovian Order in behalf of the Society for Electrical Development

is well under way and is arousing considerable enthusiasm. The campaign now being conducted through the concentrated efforts of the 12,000 Jovians scattered throughout the United States and Canada will undoubtedly be productive of excellent results.

Mr. Robertson reported that the campaign committee believes that $200,000, and perhaps more, will be subscribed by Nov. 1.

The next meeting of the board of directors of the Society for Electrical Development will be held at Association Island on Sept. 5.

In order to assist most effectively in securing subscriptions to cover the initial minimum fund of $200,000, Mr. J. Robert Crouse, vice-president of the society, has entered his personal subscription for $10,000. He has also distributed to all electrical supply dealers and contractors a pamphlet containing an article on the principles involved in the society's activity written by himself; an article on practical plans by Mr. J. M. Wakeman, general manager of the society, and an editorial on co-operation for business expansion from the *Electrical World*.

Henry L. Doherty on the Society for Electrical Development

Mr. Henry L. Doherty, president of the Society for Electrical Development, has brought forward many arguments to show the advantages obtained from membership in this society, several of which are given below.

This society makes it possible for all to co-operate and contribute toward the more rapid development of the electrical business. No such organization has heretofore existed. Without any particular solicitation, many subscriptions have already been received from those who have heretofore subscribed nothing toward such a movement simply because there was no way for them to do so. The society provides the way to accomplish results vitally important to every one connected with the electrical industry.

The society will bring about a more general intensified cultivation of the market. As matters now stand, a few central stations and a few manufacturing companies are endeavoring to carry on intensified cultivation of their markets, while many other central stations and many other manufacturers are doing little or nothing. The benefits of intensive cultivation can no longer be questioned, and without any particular expense to the society, many who are not now carrying on an intensive cultivation of their markets can be induced to do so; some need only to be told how to proceed.

Enough work has already been done to demonstrate that many manufacturing plants can be induced to make complete installations of electrical equipment; that is, they can be induced to use electricity in every way possible simply for the advertising that each individual factory will receive from being the first one to be equipped completely. With any one type of factory equipped completely and thoroughly described in a proper bulletin, each central station having the same character of factory on its lines can easily get this additional business with a minimum sales effort.

The Society for Electrical Development provides the only place where it is really feasible for every branch of the electrical business to meet on common ground to bring about the greatest application for electricity. In other words, it is the focal point at which the manufacturers' associations, the central-station associations, the contractors' associations, the jobbers' associations and others can meet and co-operate.

The society can undertake to handle national advertising campaigns more effectively than any other organization, because it will represent all the interests necessary to make such work productive and valuable.

The electrification of our steam railroads is not as remote as it seems to many people, and yet little is being done with this vast opportunity compared to what might be done. The Society for Electrical Development will exert a powerful influence for progress in this direction.

The society can meet, negotiate and co-operate with other national bodies, such as the architects and the various manufacturers. This would be impossible for an individual or a company. This one field of work alone, intelligently and aggressively handled under the society's plans, justifies the support required by the society.

The society will begin its activities in every branch when a minimum subscription of $200,000 has been received. It is impossible to visit every one personally. The men in the electrical business, as a rule, have been pioneers and not trailers. The genuine progressive spirit which has made the electrical industry what it is to-day can be shown by promptly volunteering to co-operate.

Theodore N. Vail on Regulation of Public Utilities

Mr. Theodore N. Vail, president of the American Telephone & Telegraph Company, in discussing the suit brought by the national government against his company relative to the acquisition of certain telephone properties in the Pacific Northwest as well as the pending telephone investigations of the Interstate Commerce Commission, has outlined the policy and purpose of the company in the conduct of its business and the relations of the Bell system and the public. The broad policy which controlled the building up of the great Bell system as enunciated by Mr. Vail is as follows:

"We believe in and were the first to advocate state or government control and regulation of public utilities; that this control or regulation should be by permanent quasi-judicial bodies, acting after thorough investigation and governed by the equities of each case; and that this control or regulation, beyond requiring the greatest efficiency and economy, should not interfere with management or operation. We believe that these bodies, if they are to be permanent, effective and of public benefit, should be thoroughly representative; they should be of such character and should so conduct their investigations and deliberations as to command such respect from both the public and the corporations that both will without question accept their conclusions.

"We believe that the public would in this way get all the advantages and avoid all the manifest disadvantages of public ownership.

"We believe that the highest commercial value of the telephone service depends on its completeness. We believe that this highest commercial value can only be attained by one system under one common control, and that it cannot be given by independent systems unless they are operated under agreements which result in one common control and one common interest, in effect making them a single system.

"We believe that rates should be so adjusted as to afford the company sufficient revenue to pay such wages and compensation as will secure the most efficient service and to maintain the very highest and most advanced standards of plant and apparatus. We believe that in addition such fair charges should be paid upon the investment in plant as will enable the company at any time to obtain money necessary to provide the plant required to meet the continuing demands of the public.

"We believe that any surplus beyond that necessary to equalize dividends on a fair basis should be used by the company for the benefit of the public and should be inalienable for any other purpose, and should be either invested in revenue-earning plant until it is necessary to replace a plant which may become inadequate or obsolete, or should be used to make the service cheaper or better.

"We believe that under proper governmental control and regulation the profits from promotion or operation allowed to be distributed should not be so large as to warrant or tempt complete duplication of plant and organization, with its duplication of its capital charges and its organization, operating, maintenance and depreciation expenses, and we do not believe that utilities giving at fair rates an efficient and sufficiently comprehensive universal service should be subject to limited competition, not giving such service. Competition which ignores the obligation to furnish a complete and comprehensive service is not competition, is not for the benefit of the public in that it does not reach the whole public interested.

"If, therefore, complete duplication, with its dual exchange connection and dual bills for service, is a prerequisite to complete competition, government control and regulation cannot go hand in hand with competition."

Convention Program of Northwest Electric Light & Power Association

The Northwest Electric Light & Power Association will hold its annual convention in Seattle, Wash., Sept. 3, 4 and 5. Companies throughout the States of Washington, Oregon, Idaho and Montana have promised large delegations, and it is thought that the convention will be the largest and most enthusiastic ever held by the organization. The following program is announced by Secretary Norwood W. Brockett, morning and afternoon sessions being held daily:

Address of welcome, by Mr. J. E. Childberg; address of President W. J. Grambs; announcements; report of secretary-treasurer; reports of committees; "Management and Operation of an Electric-Light Plant in a Small Town," by Mr. E. G. Robinson, manager Jim Creek Water, Light & Power Company, Arlington, Wash.; "Some Operating Problems," by Mr. J. B. Fisken, superintendent light and power of the Washington Water Power Company, Spokane, Wash.; "The Tireless Farmer: Results from Ruralizing Electricity," by Mr. J. E. Davidson, vice-president and general manager Pacific Power & Light Company, Portland, Ore.; "The Regulation of Public Service Utilities," by Mr. George A. Lee, ex-chairman of the Public Service Commission of Washington; "Recent and Proposed Legislation Affecting Public Utilities," by Mr. Norwood W. Brockett, Puget Sound Traction, Light & Power Company, Seattle, Wash.; appointment of nominating committee; "Mechanical Devices in the Accounting Department," by Mr. Y. M. White, treasurer the Washington Water Power Company, Spokane, Wash.; "The Valuation of Electric Utilities," by Mr. Henry L. Gray, former chief engineer of the Public Service Commission of Washington; "Management of a Commercial Department," by Mr. A. C. McMicken, sales manager Portland Railway, Light & Power Company, Portland, Ore.; "Use of Protective Relays on Transmission Systems," by Mr. S. C. Lindsay, electrical engineer Puget Sound Traction, Light & Power Company, Seattle, Wash.; "Some Features of the Washington Construction Rules," by Mr. V. H. Greisser, electrical engineer the Washington Water Power Company, Spokane, Wash.; "The Industrial Application of Electrical Heating," by Mr. W. H. Lines, industrial power engineer Portland Railway, Light & Power Company, Portland, Ore.; "Electricity in the Lumber Industry," by A. E. Ransom, manager Seattle office Caldwell Machinery Company, Seattle, Wash.; "Synchronizing an Electric Light and Power Company's Records and Accounts with the Characteristics of Its Business," by Mr. O. B. Coldwell, general superintendent light and power department Portland Railway, Light & Power Company, Portland, Ore.; executive session.

On Thursday evening, Sept. 4, the Seattle Jovian League will hold a rejuvenation and a theater party will be given for the ladies. On Friday afternoon visitors will be shown about the city in automobiles, all of the important parks and boulevards being included in the itinerary. This ride will be followed by a banquet for the men and a separate dinner for the ladies. There will be an excursion to the United States Navy Yard at Bremerton on Saturday at which a large attendance of delegates is looked for.

Pacific Coast Convention, A. I. E. E.

The following papers will be presented at the Pacific Coast convention of the American Institute of Electrical Engineers to be held in Vancouver, B. C., on Sept. 9, 10 and 11, 1913: "Snow and Ice Loading on Transmission Lines." by Mr. V. M. Greisser; "Mountain Railway Electrification," by Mr. A. H. Babcock; "The Gulf of Georgia Submarine Telephone Cable," by Messrs. E. P. La Belle and L. P. Crim; "A Modern Substation in the Cœur d'Alene Mining District," by Mr. J. B. Fisken; "Logging by Electricity," by Mr. E. J. Barry, and "High-Voltage Circuit-Breakers," by Mr. K. C. Randall. The convention headquarters will be at the Odd Fellows' Hall. Mr. E. M. Breed, 814 Dominion Trust Building, Vancouver, B. C., is secretary of the convention committee.

London's Transportation and Lighting

By Dr. Louis Bell

There is now a scheme afoot in London which makes railway and tramway managers rub their eyes and wonder where their dividends will be in the near future. Of course, every one knows that the London bus system stretches now over a very wide area; to Windsor, for example. But the new organization, which rejoices in the inclusive name of Greater Omnibus Services, Ltd., has plans which in their bearing on traffic are prodigious.

The scheme in brief is to initiate in every considerable city in England a branch of the new bus service, worked from a central office with interlocking traffic zones so as to give bus communications practically all over the country. The radii from some twenty-one projected centers overlap so that one could travel from Southampton to the Scottish border or from Norwich to Cardiff with comparatively few changes, no more than are needed in a similar distance over American street railways.

Observe the beautiful thriftiness of the project. The bus line has not an inch of track to lay, no overhead structure, no pavements to keep in order and practically no rates to pay. It is a "trackless trolley" with no trolley—a sort of freebooter of traffic rushing in with its whole fleet where plunder promises well, as at a race meet, and scattering later to pick up anything that is not nailed down or red hot in the adjacent counties. Labor, petrol, interest and maintenance on the buses make up the bill of expense—and motor buses pay a petrol tax of only 3 cents a gallon where private cars pay 6 cents.

Already country councils are wondering who will pay for the road repairs, which will grow at a rate to stagger the imagination. In fact, local authorities are even now beginning to plan a campaign of restriction which may be able to force the invader to terms—on the one hand, directed to road repairs; on the other, to the protection of tramways that take care of their own tracks and the rest of the street beside. The local powers to prevent the use of the roads by 5-ton marauders are somewhat limited, but there remains, by an almost facetious turn of rate, the right to prevent taking up or setting down passengers in the local domain. It is a credit to the English sense of justice that in Oxford such rights have been enforced to protect the interests of a tramway company which has been paying liberally for its use of the streets.

By the way, there still remains at Hastings a tramway of

the sectionalized, magnetic-switch variety, working, I am told, rather badly, but unable to change to an overhead trolley on account of the local authorities, or to a slotted conduit on account of the invading sea. Between the board and the deep sea it is rather hard pushed.

The lighting of London has changed wonderfully in a few years and in remarkable ways. Part of the metropolis is a carnival of press gas, another part a symphony in flame arcs, and as for the rest—well, if there is any co-ordination between sound and light then the streets of London remind one of the state of Babel after the grand catastrophe. Yet one must admit that, though the kinds are many, each after its particular fashion is good. The chief streets of London are, in fact, remarkably well lighted, and even the secondary streets rather better than in America. The tertiary lighting is not so good.

The best of the lighting is by magazine flame-arc lamps and by very high-pressure gas. Here the long-burning flame-arc lamp has hardly a show. When a 550-watt magazine lamp can give in the useful direction more than 3000 cp and requires recharging only every seventy-five hours or so, the long-burning carbon lamp at its wonted efficiency ceases to be attractive where electrodes can be imported free. A few of the long-burning lamps are in service, but it is the magazine lamp that is pushing to the front.

One good stretch of street is lighted with high-candle-power tungsten lamps, three grouped in a single lantern and replacing a big arc lamp with admirable effect. Beside all these the old carbon lamps, of which some still survive, seem about as luminous as white beans. The gas lamps are as various and interesting as the electric ones. Pressures are carried up to even 80 in. of water, and with, of course, corresponding economy in gas. The most interesting thing, however, is the carrying of these powerful gas lamps on cross-suspension. The pipe from the side is a solid one to which the lamp, carried on a trolley from the suspension, is affixed by an automatic connector so that the lamp may be dropped out of connection and trolleyed to the sidewalk for inspection or repair.

Tungsten lamps are seen everywhere, operated mostly at 220 volts, as fits the major part of the distribution systems. They come from all the corners of the Continent from makers scarcely heard of across the sea, and I have a strong suspicion from what I hear that they are mostly indifferent, benevolently dumped perhaps on the English market. Of course, the best of English lamps are excellent, but the situation in London shows at least one of the possible results of too much competition.

Meeting of Electrical Contractors' Association of Wisconsin

The annual summer meeting of the Electrical Contractors' Association of Wisconsin was held on board the steamer *Georgia*, Aug. 7-14, while the boat was making a round trip on Lake Michigan between Milwaukee, Wis., and Sault Ste. Marie, Mich. Many stops were made en route, the longest being at Mackinac Island. No formal program had been arranged, but there was a very general discussion all during the trip on matters of general interest to the members. Two short business sessions were held, at the first of which a number of electric contractors were elected to membership. The attendance was not as large as expected, but what was lacking in numbers was made up by extra enthusiasm. The following members attended: Messrs. J. D. Warden, of Sheboygan; William F. Meter, of Oshkosh; R. J. Nickles and L. W. Burch, of Madison; A. C. Longstadt, of Appleton; D. E. Roberts, of Racine; G. T. Wacker, of Plymouth; George F. Rohn, Herman Andras, B. L. Burdick and Secretary Albert Petermann, of Milwaukee.

Combination Single-Phase and Polyphase Locomotives for the Norfolk & Western

Many interesting features are embodied in the alternating-current locomotives being built by the Westinghouse Electric & Manufacturing Company for the Norfolk & Western Railway Company, outlined on page 268 of our issue for Aug. 9. The motors are of the polyphase induction type designed for three operating speeds. However, the locomotive will receive its energy from a single-phase, 11,000-volt system. A so-called "phase-splitting" device, which is in reality a rotating phase converter, will be used to produce the quadrature current relation necessary for polyphase excitation during normal operation as well as at starting.

The propelling equipment of each locomotive will comprise four polyphase induction motors of a total continuous rating of 1300 hp at 14 m.p.h. Each motor has windings for producing four and eight poles. The motors have wound secondaries for insertion of starting resistance and for connection in cascade for producing low speed in starting and switching only. There are two running speeds, 28 and 14 m.p.h., and a switching speed of 7 m.p.h.

The control of the motors will be through rheostats connected in the secondary circuits. In starting with the 7-mile combination the motor on each truck will be connected in cascade (series) and the two sets of cascades will be connected in parallel. Resistance will be inserted in the secondaries at starting. In this combination the primaries will be arranged for eight poles. With the 14-mile combination all motors will be in parallel connected for eight poles, and with the 28-mile combination the four-pole arrangement will be used, resistance being used on intermediate steps.

In choosing the induction motor in place of the commutator motor for this installation, important considerations those mentioned were those of cost and space.

Approximately balanced polyphase voltages will be applied to the primary circuits of the propelling motors. For this purpose there will be installed in the cab of the locomotive a rotating "phase splitter" or phase converter which will receive exciting and driving energy from the secondary of the single-phase step-down transformer in the cab and deliver current in time-quadrature phase relation in order to supply magnetism in time-quadrature to the direct supply single-phase magnetism in the propelling induction motors. The latter motors will therefore start from rest as polyphase induction motors. Being arranged for eight poles and connected in cascade, they will operate initially as though they were sixteen-pole machines and accelerate toward a corresponding synchronous speed, above which they will operate as induction generators to return energy to the supply system. When connected in parallel and arranged for eight poles the motors will reach a synchronous speed at twice the linear speed corresponding to cascade connection, and will return energy to the system when driven above this speed. A higher synchronous speed is again found at double the latter linear speed when the motors are arranged for four poles.

The three-speed arrangement was chosen for several important reasons. In the first place, the grades to be encountered are unusually heavy and regenerative control is of considerable advantage. This is true not so much on account of the saving in energy as from the consideration of safety in descending grades. Incidentally there is quite a saving in wear of shoes and tires. Second, the energy saving is considerable, although secondary. In descending the grades the two head locomotives will be connected to pump back into the line, and they will be fully loaded. When other trains are to be in the electric division this saving will be considerable, and it will lighten the load on the station and improve its load-factor. When the descending train is the only one on the line the energy will be absorbed in suitable rheostats in the power plant.

Macon Convention of Southeastern Section, N.E.L.A.

At Macon, Ga., Aug. 14 to 16, was held the first annual convention of the newly organized Southeastern Section of the National Electric Light Association, the attendance numbering nearly 150. Judge Augustin Daly, of Macon, welcomed the delegates. In his presidential address, Mr. E. C. Deal, Augusta, Ga., called attention to the rapid development of the electrical industry in the South, and the growth of the local association as well.

While the large number of organizations in the field may involve duplication of effort, this can be largely prevented by proper precautionary measures, declared President Deal. He commended the broad policy of electrical manufacturers in rendering engineering assistance to small central stations. The industry is now well upon the threshold of its commercial age, although, he added, complete realization of this is still to be achieved. Better understanding on the part of the public is, however, needed to offset the anti-corporation spirit fostered by yellow journals and designing politicians. The downward trend in public-utility rates, despite the increasing scale of wages, supplies, and various material costs, is one of the aspects deserving more publicity. Failures of municipal ventures should also be brought to the attention of communities contemplating such plants. Standardization of rates among central stations is another of the essentials on which the fullest public confidence depends. Questions of legislation and those dealing with labor deserve the most careful study. The creation and stimulation of employees' interest in their work is also of paramount importance in utility management. President Deal, in fact, recommended the appointment of an association committee to study labor matters.

The report of the chairman of the finance and membership committee, Mr. T. W. Peters, Columbus, Ga., showed a total enrolment of over 200, drawn from five States.

Outdoor Transformers

Mr. A. D. Fishel's paper, "Outdoor Transformers," was read in the author's absence by Mr. E. A. Thornell, of the Westinghouse company's Atlanta (Ga.) office. Current practice in the design and construction of apparatus for pressures of 2200 volts to 22,000 volts was described in detail. The comparative advantages and drawbacks of three-phase and single-phase units were also pointed out, the conclusion being that the single-phase grouping is more desirable and flexible for companies operating in cities of 100,000 population or less.

Discussion of Mr. Fishel's paper turned chiefly on topics of lightning protection. Lightning discharges, pointed out Mr. H. L. Wills, Atlanta, Ga., will always attack the weakest point in any apparatus. Efficiency, regulation, reliability, shipment in oil, moisture protection, etc., were among the transformer essentials which he enumerated. Mr. Wills also advocated pole-type three-phase transformers.

Mr. E. P. Peck, Atlanta, Ga., urged that all transformers should have excess ratings given them so as to stand overloads continuously. Owing to normal growth of the service distributing units almost invariably become overloaded before the results of inspections and surveys can be applied. Mr. Peck then described the effect of lightning and surges in applying sudden strains in windings. In service, transformers have often failed at potentials far below those previously withstood during shop tests.

Mr. C. M. Young, of Columbus, Ga., urged the standardization of regulating taps with respect to both ratio and number. He also recommended simplification of transformer-oil qualities and varieties, suggesting that a few standard kinds of oil might suffice for all purposes, in this way greatly reducing storage requirements. The severe lightning experienced in the Southeast makes the protection problem there especially difficult. In general, concluded Mr. Young, local conditions must largely determine the application of three-phase transformers.

Mr. R. M. Harding, of Columbus, Ga., remarked that although transient phenomena are largely excluded by the low electrostatic capacity of 22,000-volt transformers, oscillations may nevertheless be set up, imposing voltage strains far in excess of the original value. Such oscillations may be caused by lightning and switching, and cannot be prevented by the usual methods. Under such conditions, the presence of reactance coils may actually increase the tendency of the transformer to destroy itself by its own stored energy. Horn-type apparatus, said Mr. Harding, well takes care of the protection required for cheap outlying installations. The presence of high-frequency disturbances may often be detected by the raised frequency of the magnetic reversals, the transformer hum rising to an actual shriek.

Mr. L. A. Magraw, Macon, Ga., recounted the loss of transformers both with and without lightning arresters.

Others who contributed to the discussion were Messrs. H. E. Busse and Paul Lovejoy, both of Atlanta, Ga.

Regulation of Transmission Lines

"Regulation of Hydroelectric Transmission Lines" was the title of a paper by Mr. E. P. Peck, assistant electrical engineer Georgia Railway & Power Company, Atlanta, Ga. The author discussed the effects of resistance, reactance and capacity in determining line regulation. For calculating lines under 20 miles in length he recommended the approximate trigonometric method as preferable to the graphic scheme. For longer lines, up to 100 miles, he suggested considering the capacity as distributed at the ends and center. The convergent-series method of calculation, although involving complex quantities, requires less calculation. To neutralize capacity effect large synchronous condensers may be installed at the receiving end, and equipped with Tirrill regulators set to keep a constant voltage at that point. In conclusion the author referred doubtfully to the existence of a satisfactory lightning arrester and urged that further development be carried on.

Discussion

Mr. C. M. Young, Columbus, Ga., predicted that in the near future the transmission systems of the South will be interconnected, energy being exchanged in much the same way that railways now exchange passengers and freight. By this arrangement it will be possible for whole systems to be shut down while their load is carried from nearby stations continued in operation. In high-tension transmission work dependable intercommunication is absolutely essential. Mr. Young also voiced the need for lightning arresters which shall not be self-destructive.

Mr. L. A. Magraw, Macon, Ga., referred to the use of 2300-volt motors which avoid the outlay for transformers, but said that when attacked by lightning these high-tension motors are invariably destroyed. Mr. O. H. Caldwell, New York, gave brief data concerning the 140,000-volt Ausable (Mich.) transmission line and the capacity effects there observed. Mr. E. H. Ginn also presented some details of construction of modern lightning-arrester apparatus.

Mr. R. C. Camp, Ocala, Fla., cited instances where transformers had burned up when one side of the line became grounded, the transformer cases having been previously grounded. This, Mr. Peck explained, might have been due to the existence of arcing grounds setting up surges.

Mr. R. M. Harding, Columbus, Ga., compared star and delta connections under service conditions, pointing out the factor of safety from the standpoint of lightning protection.

Mr. G. K. Hutchins, Columbus, Ga., emphasized the commercial aspects of lightning-arrester installations as affecting the customer. In some cases interruptions to service are negligible. But for such applications as cotton mills and other characteristic Southern loads it is often a serious matter to start up the plant after a shut-down. Mr. Hutchins urged frequent drainage of lines and again emphasized the point that protection to the customer's service is in itself of the greatest importance.

Mr. H. L. Wills, Atlanta, Ga., also referred to the need for standard taps, but declared that no taps at all would be still better. He confirmed Mr. Young's plea for a standard oil, and also advocated that service transformers include all instrument windings in the single case. For intercommunication between plant and substations in case of line interruptions, Mr. Wills advocated the use of wireless-telegraph apparatus, pointing out that such equipment would be invaluable in the usual cases of system paralysis.

Mr. J. H. Robertson, Greensboro, N. C., described conditions of regulation received from a transmission-line supply service.

WORK OF THE NATIONAL ASSOCIATION

On Thursday evening Secretary T. Commerford Martin, of the National Electric Light Association, delivered an eloquent address on the accomplishments and aims of the national association, of which the Southeastern Section is a new branch. Mr. Martin spoke glowingly of the electrical development of the South and the electric operation of the cotton mills, declaring that the steel towers and shining cables which span the countryside will eventually mean more to the nation than even the steel rails which interweave its cities.

With 13,000 members the N. E. L. A. is now the largest

PRESIDENT-ELECT T. W. PETERS

engineering organization of the world. Eighteen State associations are affiliated with it, and there are forty-five company sections embracing 9000 central-station employees. In fact, its membership includes 90 per cent of the invested capital of the industry, which Mr. Martin placed at $2,500,000,000 with total earnings of $450,000,000 per year. The association's income now averages $140,000 annually.

Private management and ownership under proper regulation is the essential principle which the N. E. L. A. is pledged to support. This economic principle is indeed winning out as shown by the decrease in municipal undertakings. The secretary also sketched briefly the work of the association committees, publication of rate-research bulletins, use of the question-box and lecture bureau, co-operation of the public-policy committee with other national bodies, formulation of resuscitation rules, and the association's part in shaping the National Electrical Code and the forthcoming electrolysis rules. The labor question is one of the most vital and intricate problems which confront the central-station industry, but to-day central-station companies are absolutely divided on the "open-shop" question. In conclusion the speaker read from "Crowds," a recent psychological study which has attracted much attention, the high tribute therein paid to the work of President Dunham, of the Hartford (Conn.) Electric Company.

ELECTION OF OFFICERS

Officers for the ensuing year were elected on Saturday morning, the nominating committee having been made up of Messrs. W. R. Collier, Atlanta, Ga.; P. M. Miller, Key West, Fla., and E. A. McCoy, Columbia, S. C. The officers chosen were: President, Mr. T. W. Peters, Columbus, Ga.; first vice-president, Mr. J. E. Bingham, Tampa, Fla.; second vice-president, Mr. C. D. Flanigan, Athens, Ga.; executive committee—Messrs. R. L. Lindsay, Durham, N. C.; G. K. Dustin, Columbia, S. C.; E. S. Roberts, Savannah, Ga.; H. C. Adams, Jacksonville, Fla., and M. Webb Offutt, Birmingham, Ala. President-elect Peters then appointed Mr. A. A. Wilbur, Columbus, Ga., to be secretary-treasurer for the year, also naming as members of the public-policy committee Messrs. P. S. Arkwright, Atlanta,, Ga.; M. Webb Offutt, Birmingham, Ala., and Z. V. Taylor. Mr. W. L. Southwell, Macon, Ga., was appointed chairman of the membership and finance committee.

Mr. Thomas W. Peters, president-elect of the Southeastern Section of the National Electric Light Association, is commercial agent for the Columbus (Ga.) Railroad Company. He was born at Dublin, Md., thirty-two years ago and received his scholastic training at St. John's College, Annapolis, Md., and at Lehigh University, where he took special courses in 1904. Mr. Peters entered the business world in the employ of the Viaduct Manufacturing Company, of Baltimore, Md., later taking up operating work with the Potomac Electric Company, Washington, D. C., and the Philadelphia Electric Company, Philadelphia, Pa. Later he joined the commercial staff of the Consolidated Gas & Electric Company, of Baltimore, Md., and six years ago removed to Columbus, Ga., to become associated with one of the Stone & Webster properties, where he has since been in charge of commercial work.

A detailed report of the technical sessions of the remaining two days of the convention will be presented in a later issue.

Public Service Commission News

NEW YORK COMMISSIONS

The Public Service Commission, Second District, has denied the application of the Western Vermont Power & Light Company for permission and approval to exercise a franchise granted by the village of Granville, Washington County, to supply electricity to consumers in that village. It has approved the application of the Kanes Falls Electric Company to construct a transmission line from its generating station at Kanes Falls, through the towns of Fort Ann and Granville to the village of Granville.

OHIO COMMISSION

Attorney General Hogan has notified the Cincinnati Gas & Electric Company and the Union Gas & Electric Company, lessee, that unless the orders of the Public Service Commission in extending service to Delhi and Seyler Park are complied with, he will institute suit to recover penalties of $1,000 a day. The Cincinnati Council ordered the extensions made and the commission sustained the order.

Officers of the village of Port Clinton, a small city on Lake Erie, have filed a complaint with the commission against the Northwestern Ohio Railway & Power Company, in which it is stated that the property of the Port Clinton Light & Power Company has been purchased by the Northwestern Ohio Railway & Power Company and the real estate by the Lake Shore & Michigan Southern Railroad Company. The plant, which has been used as a distributing station since the purchase, is now being dismantled. The city officials claim that, under the franchise, the municipality has an option on the plant at the expiration of the franchise and that the sale of the property and the removal of the equipment will destroy its opportunity of purchasing it and converting it into a municipal plant.

Current News Notes

License Fee on Electric Signs in Montreal.—Following the passing of a recent by-law a license fee of 10 cents per sq. ft. will be collected annually in Montreal on all electric signs in that city.

* * *

New Alloy of Platinum.—A new hard alloy of platinum is said to have been produced by the addition of osmium. It is claimed that this alloy, which contains from 0.5 to 10 per cent of osmium, has physical and electrical properties fully equal to the platinum alloy containing a much higher percentage of iridium.

* * *

Westinghouse Relic Burns.—The old factory of the Westinghouse Electric & Manufacturing Company in Pittsburgh, where George Westinghouse's inventions were first executed on a substantial scale, was destroyed by fire on Aug. 9. The building was occupied by the Nernst Lamp Company, the Pittsburgh Electrical Specialties Company and a printing and publishing company.

* * *

Canadian Officials Recommend Instruction in Resuscitation to Railway Employees.—The Board of Railway Commissioners for Canada has issued to the railways a circular calling attention to the advisability of warning employees about the absolute necessity of keeping away from all electric wires and also to the advisability of employees becoming familiar with the recently revised rules for resuscitation from apparent death from electric shock.

* * *

Wireless Not Yet Feasible for Railroad Use.—The superintendent of telegraph of the Atchison, Topeka & Santa Fé Railway, who has been investigating the practicability of wireless telegraph for railroad purposes, has concluded that for the present the expense of installation and maintenance is too heavy and that the ease with which interference is accomplished also militates against its use for railroad purposes. Until these troubles are overcome the railroads will cling to dots and dashes and the telephone system.

* * *

Electrification of Berlin's Suburban Railways Probable.—Prussia's Minister of Public Works has expressed himself in favor of the proposed electrification of the Berlin city belt and suburban railways. The traffic has doubled on these lines within the last twenty years and steam traction is no longer adequate to handle it. Electric drive would give practically double the number of trains each hour, besides securing all the advantages of the electric system. The Prussian Parliament recently voted a credit of $5,000,000 for carrying on preparatory work upon this important scheme.

* * *

Automobiles in Perry Victory Celebration.—The plans for celebrating the centenary of Commodore Perry's Lake Erie victory in Chicago on Aug. 23 provide for a large automobile parade. A number of prizes and trophies have been offered. For the best decorated electric pleasure car the first prize will be $100 and the second prize $75. Similar prizes will be offered for the best decorated truck. The dealer having the greatest number of electric cars of one make in the parade will receive a trophy valued at $85, and to the dealer having the greatest number of electric pleasure cars of one make in the parade there will be given a trophy of equal value.

* * *

Electrical Process for Purifying Clay.—The electrical process for purifying clay brought to the notice of the English Ceramic Society by Dr. W. R. Ormandy depends upon the fact that clay is electro-negative, while its chief impurities are electro-positive. The emulsified clay is partially coagulated by adding electrolytes and is further purified by being passed through a vessel with electrodes having a difference of potential between them of from 60 to 100 volts. The clay substance, with as little as 18 to 20 per cent of water, is deposited as a continuous blanket 4.5 ft. wide and 0.25 in. thick. Even fine particles are removed, and the solid product may contain as much as 99.5 per cent of china clay.

* * *

Glasgow to Send Delegates to Study Electrical Development in America.—The Glasgow City Corporation has arranged to send on a tour to this country Mr. W. W. Lachie, the engineer of the electricity department, together with the convener of the electricity committee, for the purpose of collecting information regarding the cost and operation of the largest electrical installations of this country. The deputation will visit New York and Chicago on the advice of Dr. Ferranti, who has suggested that the Glasgow City Corporation install large units in its proposed new generating station and that before it commits itself to definite plans it should ascertain directly the best methods followed in the United States, where the work of large units can be seen to best advantage.

* * *

Ocean to Ocean Highway.—The Lincoln Highway Association, formed to secure the establishment of an ocean-to-ocean highway as a memorial to Abraham Lincoln, has established headquarters at Detroit, Mich. The highway is to cost approximately $10,000,000, of which $4,200,000 has been subscribed. The association proposes to co-operate with local communities in procuring the establishment of the highway and in improving and reconstructing existing highways which will constitute a part of the route. Several states along the line are said already to have taken steps toward the construction of improved highways from east to west to connect with the coast-to-coast route, and it has even been suggested that the highway be lighted by electricity. Mr. H. B. Joy is president of the association.

* * *

Control of Flood Water by Reforestation Impracticable.—According to Colonel C. McD. Townsend, of the United States Corps of Engineers, it is generally accepted that the leaves falling from forest trees as they decay form a humus which has a large capacity for absorbing water. It requires from twenty to fifty years to produce a good forest growth, and a century for the leaves of that forest to decay in sufficient quantities to produce the humus which will be satisfactory as an absorbent of rainfall. It is therefore apparent that even under the most extravagant claims of forestry advocates reforestation as a means of reducing flood heights requires the conversion of too much farming land into a wilderness to be practicable. The waste land that can profitably be converted into forest reservations is too limited in area to produce an appreciable effect on floods.

* * *

Hydroelectric Possibility on the Columbia River.—At a total cost of about $23,000,000, it is claimed that a large hydroelectric development can be located at Big Eddy, on the Columbia River, a few miles above The Dalles, Ore. The gorge at this point is of such a character that little work will be required to impound sufficient water to develop 300,000 hp. The river can be entirely closed by the construction of a dam 300 ft. long and 180 ft. above its foundations and the construction of a canal 300 ft. wide, 20 ft. deep and 1.5 miles in length. The head of water at low tide would be 73 ft. and at high tide 42 ft., the mean flow of the river throughout the year being 235,000 cu. ft. per second. At the present time the section of the country in which this plant would be located is plentifully supplied with electrical energy, so that, ignoring entirely the difficulty of raising the $23,000,000, the possibility of such a development is rather remote.

Combination Railway, Electric and Ice-Making Plant

Turbines displace engines in reconstructed station of the Newport News & Old Point Railway & Electric Company at Hampton, Va.—Rearrangement of auxiliaries and economies effected. By A. R. Smith

JUDGING from the condition of many small steam-electric power plants, it is obvious that too little attention is given to possible improvements which would reduce the operating costs and improve the service. Frequently the obsolete equipment is kept in operation at an enormous expense and with such poor service as not only to make it impracticable to secure new business but often to result in a loss of existing trade. In most communities the lighting business has increased steadily, aside from the efforts of the lighting company to increase the output, and many cases have come to the writer's attention where the lighting and motor load has increased at the rate of 10 per cent a year. A careful study of the loss of business or the failure to secure new business should be made to determine the real cause, and the trouble will frequently be found in the power house.

Intended improvements and extensions are commonly made to old power stations without obtaining the results expected. This is due to the lack of proper engineering advice. In many cases such improvements and extensions have really been a detriment to changes made necessary at a later date. It is true that no one can foresee the future of any power house, and therefore no one should define a limit and thereby restrict the possibilities of future growth.

OPERATING COST RECORDS

The absence of detailed operating cost records or the confusion of such records with the cost of operating other branches of the business is largely responsible for many mistakes which have been made on extensions and improvements. If the proper operating cost records are kept, it is a comparatively simple matter to ascertain if certain improvements are economical or if the fault lies in the operation of the station. There are certain salient factors that enter into the operating cost which should preferably be kept month by month in the form of a curve to illustrate any increase in cost or decrease in output, as follows:

Heat units per pound coal.
Cost of coal per ton delivered.
Net pounds steam generated.
Load factor of boilers.
Temperature of feed water.
Cost of city water used.
Pounds steam per pound coal.
Cost of steam per 1000 pounds.
Vacuum.
Load-factor (monthly).
Pounds coal per net kilowatt-hour.
Cost per net kilowatt-hour (excluding repairs).
Total cost per net kilowatt-hour.
Repairs to boilers.
Repairs to prime movers.
Repairs to piping.
Other repairs.

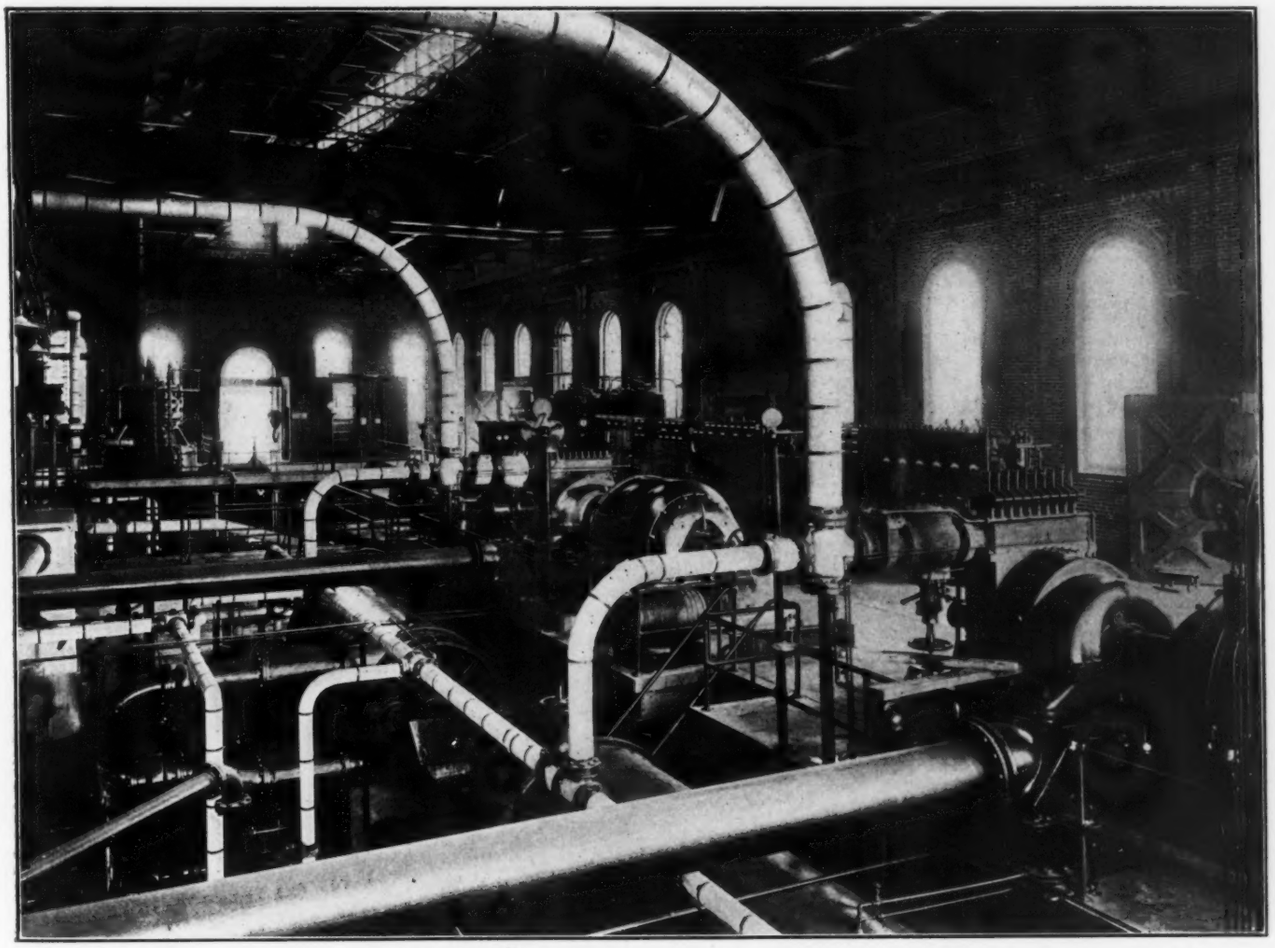


FIG. 1—REMODELED STATION OF THE NEWPORT NEWS & OLD POINT RAILWAY & ELECTRIC COMPANY

When making extensions to an existing plant great care should be exercised in arranging the new apparatus to permit of still further enlargements and replacements, thus directing the growth of the plant along broad and well-defined lines. This advice will be appreciated by those who have observed the growth of many plants which have expanded far beyond the management's expectations and where this has resulted in a conglomerate mass of machinery difficult to operate and repair and unreliable in service.

POWER-HOUSE RECONSTRUCTION

One of the most striking examples of remodeling an old power house will be found in the improvements made in the generating station of the Newport News & Old Point Railway & Electric Company of Hampton, Va., under the management of Allen & Peck, Inc., of Syracuse, N. Y. Reference to Figs. 3 and 4 will show changes made in the generating room while the system was kept in continuous operation without outside assistance. The writer does not purpose to give a lengthy description of the work but to enumerate some of the interesting features and record the equipment for reference. Before the change the equipment was as follows:

One 1500-kw, 10,000-volt, three-phase vertical Curtis turbine.
One 750-kw, 3450-volt monocylic cross-compound McIntosh & Seymour engine set.
Two 300-kw, 3450-volt monocylic tandem-compound Rice & Sargent engine sets.
One 500-kw, 500-volt direct-current cross-compound St. Louis engine set.
One 325-kw, 500-volt direct-current tandem-compound Rice & Sargent engine set, together with miscellaneous exciters, condensers, transformers, switchboards, etc.

All of this equipment with the exception of the turbine was disposed of as junk, and the engine foundations, which consisted of brick laid in cement, were completely removed. The vertical turbine-generator was rewound for 3450 volts at 1800 kw and two new 2000-kw, 3600-r.p.m. horizontal Curtis turbines were installed, making an aggregate capacity of 5800 kw, with space for a 5000-kw unit, as against a previous maximum capacity of 3675 kw.

The power-house equipment now consists of:

Six 250-hp Babcock & Wilcox boilers with Murphy stokers.
Two 400-hp Babcock & Wilcox boilers with Murphy stokers.
One 570-hp Heine boiler with stationary grates.
One coal-handling equipment, Exeter Machine Works.
One "Brownhoist" 10-ton steam locomotive crane.
Two General Electric 2000-kw, 3450-volt, 60-cycle, 3600-r.p.m. horizontal turbo-generators.
One General Electric 1800 kw, 3450-volt, 60-cycle, 900-r.p.m. vertical turbo-generator.
Two C. H. Wheeler 6000-sq. ft. surface-condenser equipments.
One C. H. Wheeler surface-condenser equipment.
One Cochrane 300-hp open-feed-water heater.
Two Alberger 185-gal. per minute turbine-driven boiler-feed pumps.
Three General Electric 750-kw, 3450/10,000-volt, single-phase oil-cooled transformers.
Six General Electric 165-kw, 3450/430-volt, single-phase oil-cooled transformers.
Two General Electric 500 kw, 720-r.p.m., six-phase converters.
One General Electric switchboard.
Piping furnished and installed by the Best Manufacturing Company.

Many of the frequent and continued interruptions of service were attributed to the loss of circulating water during low tides. As a matter of fact, the real trouble was poorly constructed intakes and long suction lines. The intakes were of wood of insufficient depth and provided with fixed screens which could not be removed for cleaning. One suction line was over 300 ft. long and the other approximately 200 ft. long with a vertical lift of 8 ft. to the pump floor. At times four hours have been consumed in regaining the suction by means of the vacuum pump. During the process of reconstruction a leak developed at a joint, previously repaired, in the 300-ft line, and it was sealed with water by building a temporary well around the defective joint until the old line was abandoned. Trouble from this source has now been eliminated by the construction of a concrete intake, the bottom of which is 5 ft. below extreme low tide and which has double removable screens having an effective area of four times the area of the intake tunnel. New concrete intake and discharge tunnels 4 ft. wide and 8 ft. deep

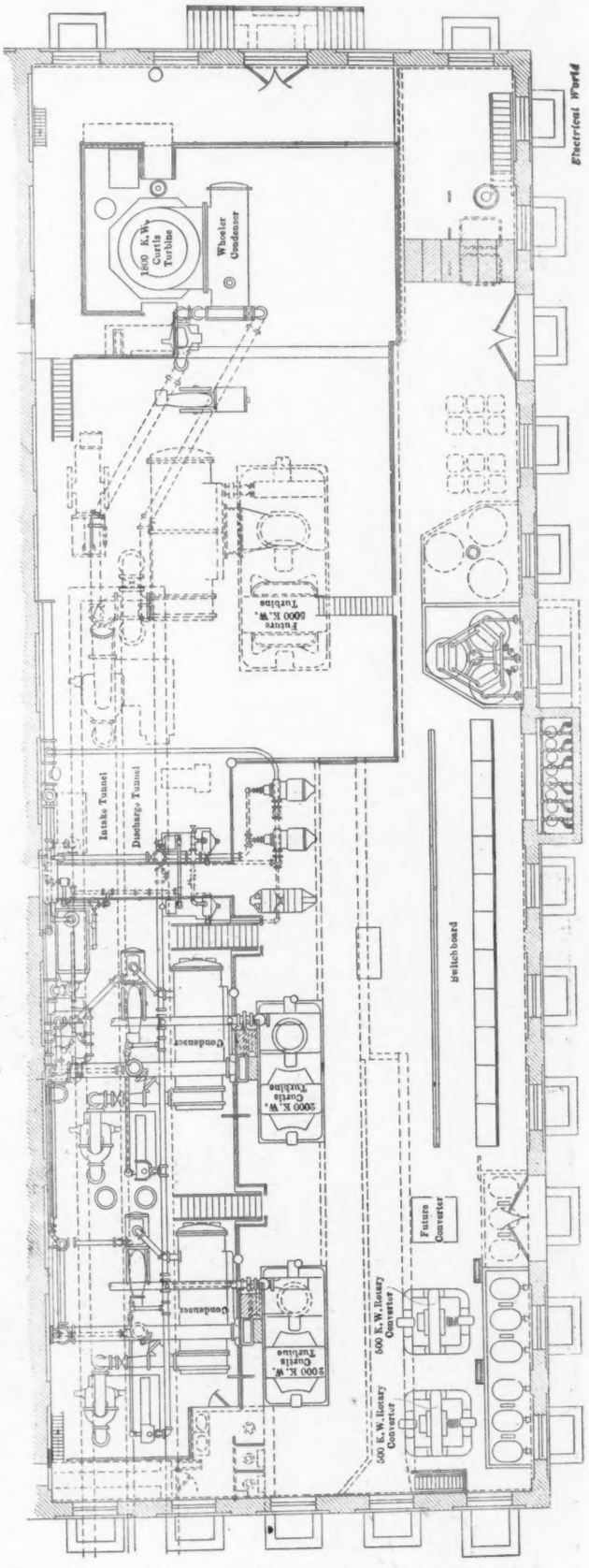


FIG. 2—PLAN OF RECONSTRUCTED GENERATOR ROOM

were constructed to carry the water by gravity to points directly under the circulating pumps. At extreme low tide

the tunnels will contain 4 ft. of water, which permits of their being cleaned without interruption of service and with little discomfort to the workmen.

and barnacles. This has been remedied by installing 1-in. condenser tubes in place of 5/8-in. tubes and providing facilities for flushing the condensers by reversing the flow of

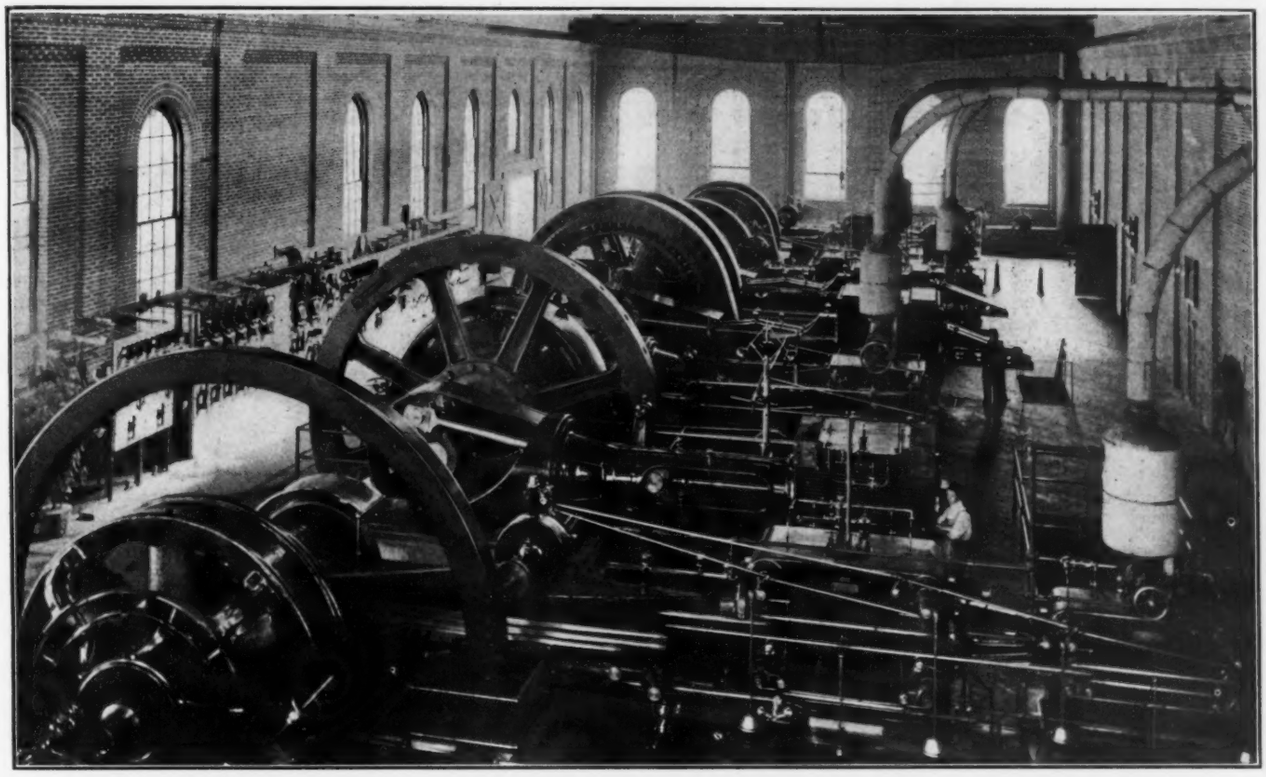


FIG. 3—GENERATOR ROOM OF NEWPORT NEWS & OLD POINT RAILWAY & ELECTRIC COMPANY BEFORE THE CHANGE

FIG. 4—GENERATOR ROOM OF NEWPORT NEWS & OLD POINT RAILWAY & ELECTRIC COMPANY AFTER THE CHANGE

Another source of trouble with the old equipment was the clogging of condenser tubes with floating material, fish

circulating water through them. A still further precaution against loss of circulating water in case of the combination

of a severe westerly wind and low tide, which has a tendency to empty the creek, was to install 42-in. valves between the turbines and condensers to permit of non-condensing operation.

The old piping was typical of that installed in engine stations of that period, (about 1900), having many runs in duplicate and a double steam header in a most inaccessible

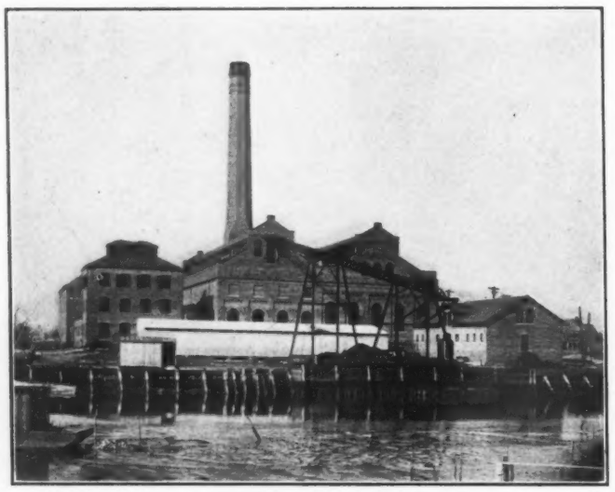


FIG. 5—OLD COAL-HANDLING EQUIPMENT AT HAMPTON

position back of and above the boilers. The losses due to leaks in steam piping just previous to placing the new piping in service required the operation of an additional 250-hp boiler. The new steam header has been erected in the turbine room, together with a steel gallery, where every valve and fitting is readily accessible and may be repaired without any discomfort. All the main steam piping is made up of cast-steel fittings and Van Stone joints, so there will be no changes necessary when the superheaters are added to the boilers. The boiler-feed piping is of standard-weight brass pipe with cast-iron fittings. It will be noted from Fig. 1 that that portion of the turbine room near the boiler-room wall is entirely open down to the basement floor, which insures good ventilation and light, accessibility to all piping and auxiliaries, and keeps all moving apparatus under direct supervision of the engineer.

The old plunger boiler-feed pumps which were formerly in the boiler-room basement were discarded and replaced by two turbine-driven centrifugal feed pumps in the turbine room. The boiler room is now devoid of moving machines except for the stoker engines. These pumps were installed without regulators of any kind, as it was found that without any boilers feeding the pressure increased only 5 per cent. Of course, care should be taken to avoid this condition, as the churning of the water in the pump casing will raise the temperature to a dangerous limit. It was interesting to note the steady pressure of the rotary pump as against the fluctuations produced by the plunger pumps. The steam drums of the 40-hp boilers were considerably higher than on the 250-hp boilers, and it was frequently necessary to change the speed of the plunger pumps to apportion properly the feed to the two sizes of boilers. With the new pumps this is accomplished perfectly by the throttling of the feed valves.

As there is no fresh water available except the city supply, and as it is very desirable to utilize all water heated above the temperature of the supply, the city water used for turbine-bearing cooling, pump thrust-bearings and vacuum sealing is collected in a tank above the open heater and fed to the heater as make-up water. City water is automatically fed into this tank in case of deficiency.

The floor supporting the boilers consisted of steel resting on steel columns and arched between I-beams with brick and concrete, leaving the bottom flanges of the floor beams and the main girders exposed to the corrosive action of moisture and fumes from the ashes. Many of the beams were set in pairs and the presence of the arches at the side precluded the use of protecting paint. The steel had deteriorated to such an extent that in some instances the beams sagged 1 in. at the center. What really sustained the weight of the boilers was difficult to ascertain. New steel beams were placed under the old ones and the girders and columns were incased in concrete with reinforcing rods to form arches. The new ash hoppers, which are of ⅜-in. sheet steel, are bolted in place to permanent angles protected by concrete so that they may be easily replaced. The folly of not protecting boiler-room steelwork with concrete, or at least eliminating all vapors and leaks, was very forcibly illustrated in this station.

To preserve the boiler blow-off water and to furnish a storage in event of the failure of the city water supply, a concrete tank 40 ft. long, 11 ft. wide and 4 ft. high was constructed just to the rear of the boiler room. The tank is divided at the center by a charcoal filter. The one compartment forms a receptacle for the blow-off and is provided with a stack vent baffled with perforated sheet iron. The blow-off water then passes through the filter to the other compartment and thence by gravity back to the station, where it is pumped into the heater. This tank also acts as an equalizer to prevent the overflow of condensate during load fluctuations when the boiler feed is less than the condensate supply.

COAL AND ASH-HANDLING EQUIPMENT

Coal is supplied by 500-ton barges at the dock. The old coal-handling equipment had a capacity of 10 tons an hour and required the services of six men. It had no outside storage facilities and little reclaimable bunker capacity. The new coal-handling equipment has a capacity of 50 tons an hour and can be operated by one man except for the trimming of the barges. Coal is delivered to the crusher and scales by a "Brownhoist" 10-ton steam locomotive crane, thence to an outside 500-ton steel suspended bunker by a belt conveyor. Coal is delivered to the boilers by an electrically operated 2-ton weigh larry, which runs on tracks

FIG. 6—GENERATOR ROOM DURING RECONSTRUCTION PERIOD

over the Murphy stoker and under the bunker. By way of explanation, it should be stated that there was not sufficient space in the boiler room to erect an overhead bunker. An outside storage of 2000 tons of coal is available.

The ashes were previously removed by push-cars and a hand elevator, the ashes being handled five times before delivery to the track as ballast. Now a standard-gage track

is carried in the basement under the ash hopper and the ashes are removed in a single handling..

AIR SUPPLY

The air supply and discharge for the turbines is taken care of by two parallel air chambers 9 ft. high and 4 ft. wide running longitudinally and separating completely the electrical equipment in the basement from the steam auxiliaries. Dampers in the intake to each turbine make possible the correct apportionment of air to each unit. The discharge of the air outside the building materially reduces the noise. Space has been reserved for the installation of an air washer at some future date.

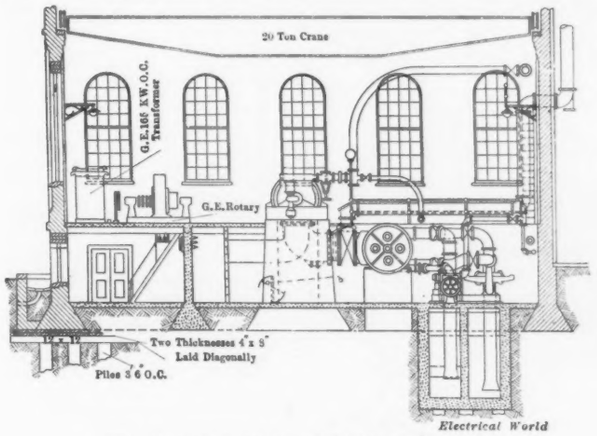


FIG. 7—SECTION OF REMODELED STATION

METERING STEAM AND ELECTRICITY

Particular attention has been given to the metering of all steam and electric energy, to facilitate the proper allocation of expenditures. The steam and water-flow meters are of General Electric manufacture.

The water and electricity are metered as follows:

Total Water to Boiler.—Steam to each turbine; steam to ice plant; steam to auxiliaries (that part chargeable to the boiler room is estimated).

Electric Energy Generated by Each Turbine.—Railway service; commercial light and motor load; municipal lighting; turbine-room lighting; turbine-room motors; boiler-room lighting; boiler-room motors; ice-plant lighting; ice-plant motors.

SUBSTATION

The substaition at Newport News is a new fireproof structure containing two rooms, one for the transformers and the other for the switchboard and converters. Automatic fire-doors cover the connecting opening. The arrangement is simple, with oil switches in concrete cells and open high-tension wiring. The cost of the building was 11 cents per cubic foot of content; if it had been used exclusively for railway service it would have cost $2.25 per kw, including plumbing.

The only unusual feature of the substation is the ventilation of the transformer room. Besides the usual number of windows twelve cast-iron louver panels were placed in the outside wall down near the base of the transformers and three 24-in. metal ventilators were placed in the roof. No provision is made for shutting off the ventilation, thereby insuring sufficient fresh air in all kinds of weather.

ICE PLANT

The Hampton ice plant, which is adjacent to the power house described in the foregoing, had a rated capacity of 100 tons of ice and contained two ammonia compressors, one a 40-ton 14-in. by 28-in. tandem compound-condensing Frick machine, and the other a 60-ton 16-in. by 24-in. tandem compound-condensing York machine. The 40-ton freezing tank had fallen into disuse, and, owing to inadequate auxiliaries, both compressors were operated on the 60-ton tank during hot weather without getting full capacity.

The plant has now been completely overhauled, and recent records show that with an outside temperature of 100 deg. in the shade a regular output of 105 tons of ice per day can be maintained aside from the refrigeration of storage rooms, estimated as equivalent to 3 tons or 4 tons of ice production.

The Shipley type of atmospheric ammonia condensers were constructed out of the old atmospheric condenser of the 40-ton equipment by purchasing ejectors and sprinkling troughs. The stands are 20 ft. long and are made up of 2-in. pipes twelve pipes high. Seven stands were erected for the 60-ton and five stands for the 40-ton compressor. Each stand takes approximately 60 gal. of water per minute, and on the warmest day recorded the temperatures and pressures were as shown in Table I.

TABLE I—PRESSURES AND TEMPERATURES OF CONDENSERS

Item	60-Ton	40-Ton
Head pressure, lb	220	215
Back pressure, lb	20	20
Output, ice, tons	60	45
Incoming water, deg. Fahr	80	80
Outgoing water, deg. Fahr	98	98
Air temperature, deg. Fahr	100	100

TABLE II—TEMPERATURE OF COOLERS

Item	60-Ton	40-Ton
Incoming Wort, deg. Fahr	210	210
Outgoing Wort, deg. Fahr	84	90
Incoming cooling water, deg. Fahr	80	80
Outgoing cooling water, deg. Fahr	110	118

The Wort coolers are of similar construction to the condensers, but are made of standard-weight galvanized-iron pipe and consist of three stands for the 40-ton equipment. These are supplied from the same water and pumps as the condensers, but use only 30 gal. per minute per stand. Table II shows the temperatures with an outdoor temperature of 100 deg. Fahr.

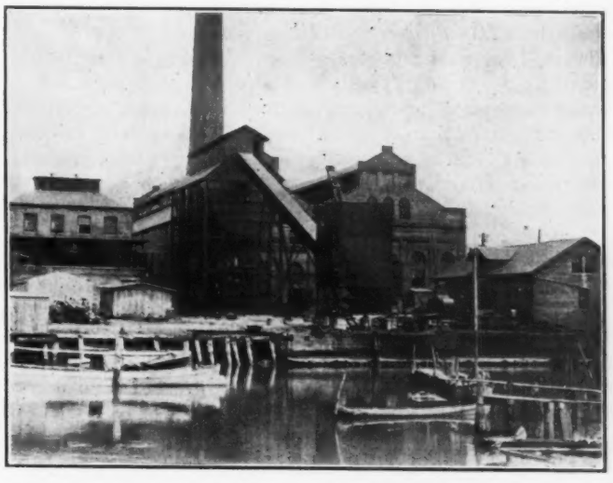


FIG. 8—NEW COAL-HANDLING EQUIPMENT

The 40-ton freezing tank, containing 12,880 ft. of 1¼-in. pipe and 596 300-lb. cans, which was formerly operated on the dry-gas system, has been changed to a wet-gas system by installing a 30-in. by 8-ft. accumulator set down in the tank. A 6-in. air space underneath the tank was filled with

fine regranulated cork by blowing it in with compressed air and thoroughly sealing it with waterproof paper and hard pine. The sides, which were formerly of wood and were badly decayed, were replaced by walls of hollow tiles and 8 in. of regranulated cork.

The 60-ton freezing tank, containing 12,036 ft. of 1¼-in. pipe and 720 300-lb. cans arranged for the flooded system, was changed to a wet-gas system by the addition of two 20-in. by 8-ft. accumulators. The bottom of this tank is insulated with cinders, to change which would necessitate raising the tank, an operation that hardly seemed justifiable.

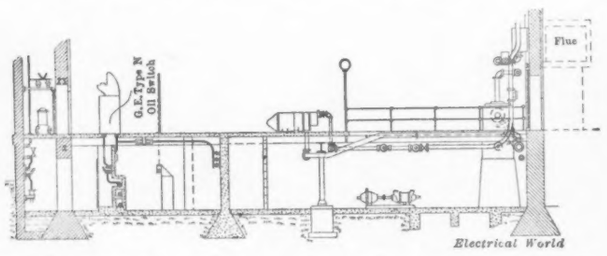


FIG. 9—SECTION SHOWING AUXILIARIES AND BUS COMPARTMENTS

New handling rooms of 450 sq. ft. and 750 sq. ft. were devised for the 40-ton and 60-ton tanks respectively, and these, together with two storage rooms of 680 tons capacity, are refrigerated by direct expansion.

All old piping was replaced or re-erected, all screw joints on ammonia piping being well soldered. The ammonia condenser headers in the freezing tanks are made continuous with welded nipples.

The Wort storage tanks are cooled by direct expansion and not by passing the return gas from the freezing tanks through the coils. Each tank contains 300 ft. of 2-in. pipe, and the water leaves these tanks at 40 deg. Fahr. for the freezing cans.

Electric Service in Connection with the Cape Cod Canal

In the progress toward completion of the Cape Cod Canal, in Massachusetts, connecting Buzzards Bay with Cape Cod Bay and planned to establish a shorter water route between Boston and New York, electricity is performing valuable service. Although this is one of the oldest engineering projects in the country in point of its early conception and investigation, it is only within the last four years that construction has been carried forward continuously in a comprehensive and successful manner, under the financial backing of Mr. August Belmont, of New York City.

The idea of a canal was conceived soon after the landing of the Pilgrims at Plymouth, Mass., early in the seventeenth century. Surveys and governmental reports were features of the later history of the Bay State, and construction was undertaken in a haphazard way at various times but without making much headway. It is interesting to note that as far back as 1883 on one of the many attempts to carry the enterprise ahead night work was done with the aid of electric lighting. The actual start of the present work, which is to be completed in 1914, under the engineering direction of Mr. William Barclay Parsons, of New York, followed no less than forty years of failures to build the canal.

The value of the new waterway to Eastern coastwise shipping cannot easily be exaggerated, as the annual toll in lives and property through shipwrecks occurring on the outer coast of Cape Cod and the loss in time by vessels being obliged to delay their passage around the storm-swept headlands crowned by Highland Light have been heavy burdens for many years. Upward of 500,000 passengers and 25,000,000 tons in vessels and cargoes yearly round the cape, and the canal will not only shorten the distance between Boston and New York by 66 miles but will also save a great deal of time in rough weather.

The canal is about 8 miles long, extending from Buzzards Bay, in the town of Bourne, to an outlet in Cape Cod

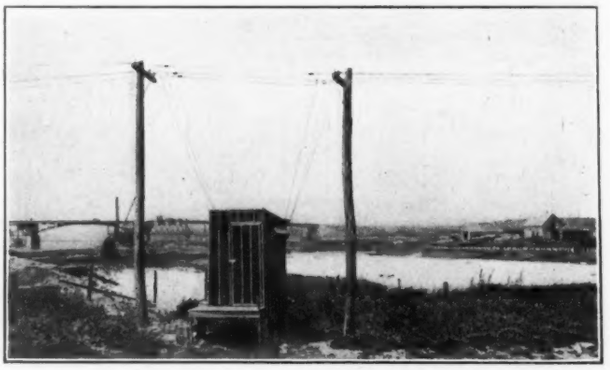


FIG. 1—METER, SWITCH AND FUSE HOUSE

Bay in the town of Sandwich, following the general course of the Monument River. The minimum width of the bottom is 100 ft. and it has a depth of 25 ft. below mean low water. The first part of the work was done by sand suction dredges, but as the contractor encountered stones and boulders in the later portions toward Sandwich, it became necessary to employ steam shovels. There at once arose a demand for pumping service between two temporary dams which had been built to discharge the Monument River into Cape Cod Bay, and this service is being furnished by the Buzzards Bay Electric Company from its Falmouth generating station. Two highway bridges and a railroad bridge also cross the route of the canal, and these are electrically operated by energy at present supplied by the New Bedford & Onset Street Railway Company. When the canal is completed it is probable that all this service will be handled by the Buzzards Bay company, and it is also planned to light the entire route of the canal by 40-cp series tungsten lamps installed in pairs on opposite sides of the waterway and longitudinally 400 ft. apart, to guide passing vessels through the artificial channel.

Energy is brought from the Falmouth station by a temporary 6000-volt transmission line with grounded neutral which will ultimately be rebuilt on another location for 33,000-volt three-phase service. The present line is carried

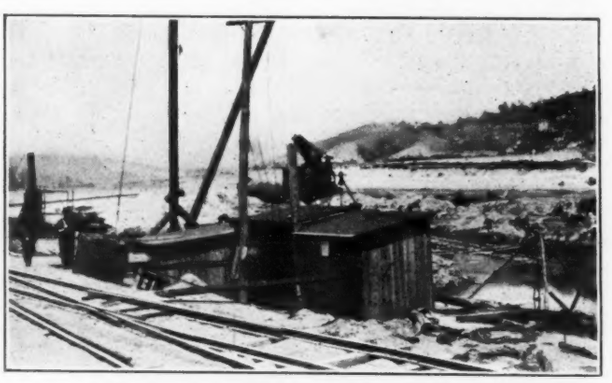
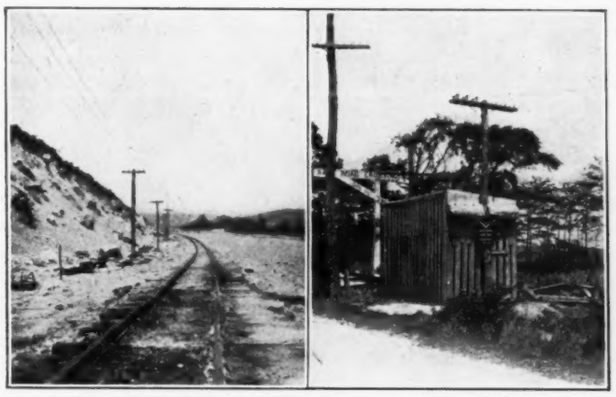


FIG. 2—MOTOR-DRIVEN PUMPING INSTALLATION

into a home-made meter, switch and fuse house shown in Fig. 1. The house is 6½ ft. long and 5 ft. wide and is carried 3 ft. above the ground, with drip loops and tar-paper walls. The connections are made on the outside of two sets of strain insulators installed between adjacent poles. At Bourne the pressure is reduced to 2300 volts in a

transformer station illustrated in Fig. 4, this installation consisting of three 100-kva, 60-cycle, oil-cooled transformers housed in a temporary 19-ft. by 9-ft. by 11-ft. wooden shack with asbestos paper roofing, the house being built with slatted sides to facilitate ventilation. At this point a connection is made with the 2300-volt lines of the Marion



FIGS. 3 AND 4—THREE-PHASE LINE AND TRANSFORMER STATION

Gas Company, providing an alternative means of energy supply in emergencies.

The canal electric service is provided by a three-phase No. 4 copper line paralleling the route of the channel as shown in Fig. 3 and located beside the railroad right-of-way used by the contractors on the job. The poles are 25 ft. in length and are installed 125 ft. apart. About 2 miles from Bourne a 100-hp pumping installation, illustrated in Fig. 2, is in service twenty-four hours per day, unwatering the westerly end of the canal channel behind a temporary dam. Two 50-hp, 440-volt motors are in service, each being directly connected to a 12-in. centrifugal pump which discharges the water from the channel location into the Monument River to maintain clear working conditions for the steam shovels. All the pumps on the canal are directly coupled to their respective motors. Three outdoor transformers of 100-kw rating are installed for the above pumping equipment, with a No. 6 secondary circuit from the transformers to the pump house.

Near the easterly end of the canal section now inclosed by a dam is an installation of four centrifugal pumps, two being of the 6-in. size and driven by 10-hp motors, and the others 12-in. pumps driven by 50-hp motors. All the

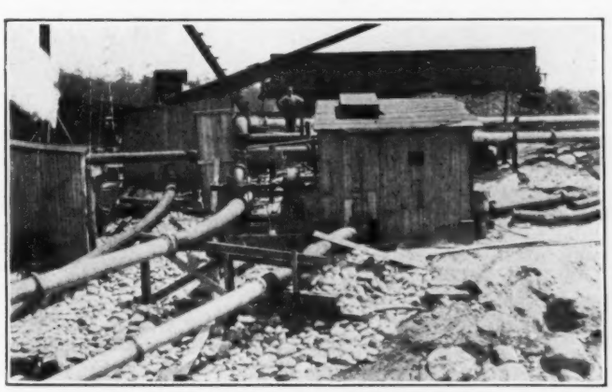


FIG. 5—MOTOR-DRIVEN PUMPING INSTALLATION

motors are of the induction type and are operated about sixteen hours per day. The transformer equipment provided here includes six units of 150-kw total rating and the secondary distribution is at 440 volts. At this portion of the canal the water is also discharged into the Monument River and thence into Cape Cod Bay, pending the completion of the work. The river was diverted in its course some months ago to enable the steam-shovel work to be carried on successfully. The heads are low, varying from 25 ft. to 30 ft. General Electric and Westinghouse motors are used, the pumps being chiefly of Jeanesville or Lawrence make. Two 1½-in. centrifugal pumps are also in

FIG. 6—MOTOR-DRIVEN BRIDGE AT BUZZARDS BAY

service, each driven by a 2-hp motor. They supply water to feed tanks from which the boilers of the contractor's small locomotives are replenished, and the motors are provided with automatic float switches governed by the height of water in the feed tanks.

The railroad bridge at Buzzards Bay is a double-track structure of the Strauss trunnion bascule type and carries the main line of the New York, New Haven & Hartford Railroad on the Boston-Provincetown route. Its span is 160 ft. and it is operated by two 65-hp General Electric direct-current motors designed to make 440 r.p.m. on a 550-volt circuit. The bridge is also provided with a 3-hp locking motor and an electric locking mechanism controlled from a signal tower at the Buzzards Bay station, about 600 ft.

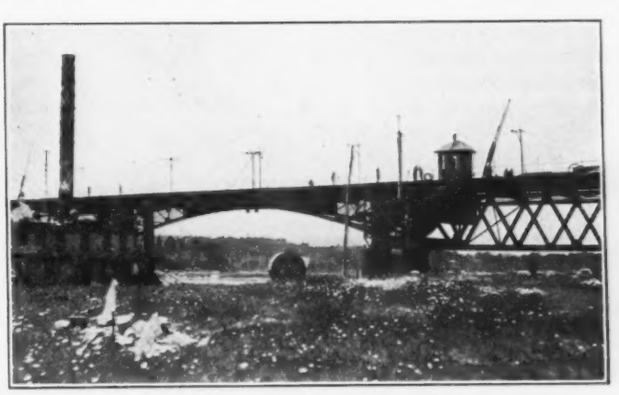


FIG. 7—MOTOR-DRIVEN ROLLER-LIFT BRIDGE

north of the bridge. The operating cabin from which the bridge motions are immediately governed is at the side of the bridge and contains a main switchboard, with ammeter, voltmeter, fuses and controllers, meter and pilot-light equipment, the latter showing the position of the bridge and its lock at all times.

Each of the highway bridges is of the Scherzer rolling-lift type, 160 ft. long, with a 30-ft. roadway and a 6-ft. sidewalk, and is driven by two 25-hp, 550-volt direct-current railway type motors. Each motor is provided with two electrically operated brakes and a hand brake. On each end of each highway bridge is a safety gate operated by a 2-hp motor through a worm and gear drive, these being controlled from the bridge tender's cabin. Red and white indicating lamps, cut in and out by switches in the draw-tender's cabin, are located on standards at each end of the bridge, and incandescent lamps are also employed in "spotting" the railroad bridge targets to insure accurate adjustment of the leaves and to govern the movement of vessels toward the bridge openings in the canal.

Condenser-Current Method for the Determination of Alternating Wave-Form

By Frederick Bedell

The early and well-known methods for determining wave-form by instantaneous contact have seen good service for many years but have their recognized limitations on account of variations in the duration of the contact and in its resistance and the lack of sensitiveness of the reading instrument when the duration is made very small. In theory the duration of contact should be infinitely small whereas in actual practice it must be finite. The condenser-current method for determining wave-form is an integrating method, the instrument being in circuit all the time. In

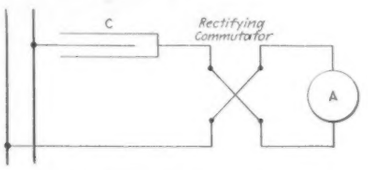


FIG. 1—CONDENSER BRIDGED ACROSS THE LINE

range and in sensitiveness it surpasses all other methods. The voltage may be a fraction of a volt or the highest voltage obtainable, and with suitable shunts a current of practically any magnitude can be measured.

For determining wave-form of voltage, a condenser C is bridged across the line as in Fig. 1. The condenser current, rectified by a synchronous rectifying commutator, is measured by a direct-current milliammeter A, or a millivoltmeter, or by any low-resistance galvanometer of the D'Arsonval type. The commutator reverses the ammeter connections every half cycle. By shifting the brushes and reading the position of the brushes on a suitable scale, this commutation may be made to take place at any desired part of the cycle. Let C be the capacity of the condenser in farads, f the frequency of the circuit in cycles per second and A the current reading of the ammeter in amperes for any brush setting. The corresponding instantaneous voltage is $e = A \div 4fC$. Readings of A are taken for successive positions of the commutator brushes and the wave-form of voltage is thus determined.

To determine the wave-form of current, a shunt resistor R is placed in series with the circuit, as in Fig. 2. The condenser C is connected across its terminals, the commutated condenser current being measured by the ammeter or galvanometer A. The wave-form of current is then determined in the same manner as the wave-form of voltage.

The sensitiveness of the arrangement, either for current or voltage, can be varied by changing C or by means of a resistor in shunt with the galvanometer on either the line side or galvanometer side of the commutator.

The theory of the method is as follows: The relation at any instant between the charge q of the condenser and the current i is $dq = i\,dt$. During any time interval of half a period T—that is, from any time $t = t_1$ to $t = t_1 + T/2$—the charge changes from $+q$ to $-q$, the positive and negative waves being similar. Integrating for half a period, one obtains

$$\int_{+q}^{-q} dq = \int_{t_1}^{t_1 + \frac{\pi}{2}} i\,dt.$$

But the reading of the ammeter is

$$A = \frac{2}{T} \int_{t_1}^{t_1 + \frac{\pi}{2}} i\,dt,$$

this being the average value of the current during a half cycle subsequent to any time t_1. Hence one may write $2q = TA \div 2$; or $q = TA \div 4$. Writing $1/f$ for T, and Ce for q, one obtains $e = A \div 4fC$.

It will be seen that the method can be applied only to waves in which the negative wave is a repetition of the positive—that is to waves in which there are no even harmonics.

An integrating method for determining wave-form of flux is well known and a somewhat similar method, employing an air transformer, has been used for determining wave-form of current and voltage. The air transformer method, however, is restricted in range and is liable to error, particularly on very low voltages, if the constants of the circuits are not properly selected. On very high voltages the air-transformer method can scarcely be used on account of the necessity of drawing current through a resistor that

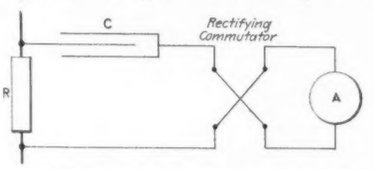


FIG. 2—CONDENSER SHUNTED AROUND A RESISTOR

absorbs energy instead of through a condenser that absorbs practically none.

In the condenser-current method there is little difficulty in selecting an instrument and a capacity that make errors negligible. For accuracy the resistance r of the instrument and circuit, including the commutator, should be small as compared with the reactance x of the condenser. Calculations for a particular case will show how small is the error introduced by the resistance. For example, using a certain millivoltmeter on a 110-volt, 60-cycle circuit: $r = 2.75$ ohms; $C = 0.4$ mf; $x = 6640$. The phase angle of the current in the condenser is shifted by an angle $\tan^{-1} r/x = \tan^{-1} 0.0004$, a little over one minute. The effect of the resistance upon the amplitude of the current is negligible, for the impedance $\sqrt{r^2 + x^2} = 6640.00057$ is practically determined by x alone. A much greater value of r and a much smaller value of x could be used without introducing significant error. Where a number of current and voltage curves are to be taken and their phase positions are to be accurately compared, for greatest accuracy r/x should have the same value in taking each curve; that is, if x is changed, r should be changed to correspond. In most cases, however, this refinement is unnecessary.

The condenser-current method has been found satisfactory and is recommended for its general usefulness. In a paper* soon to be published on "The Use of the Synchronous Commutator in Alternating-Current Measurements," the writer discusses more fully the use of the commutator in alternating-current measurement and gives a résumé of methods that have been used or proposed, with a bibliography.

*Journal of the Franklin Institute.

A Study in Depreciation

By Dr. Louis Bell

This year is the twentieth anniversary of long-distance energy transmission in the United States. Near the beginning of the year 1893 the San Antonio Canyon plant, started late the previous year, got settled down to regular business on the San Bernardino line, this being the first 10,000-volt transmission system used for commercial purposes. It was a single-phase line operated without a motor load. Early in September, the first of the American three-phase plants was started at Redlands, where there were two 250-kw generators, directly connected to Pelton wheels in what is now the No. 1 Mill Creek power house. The voltage at the machines was carried between 2600 and 2700, the rated terminal value being 2500 volts. The arc lighting of Redlands was carried by Brush arc machines installed in the same station and directly coupled to Pelton wheels. The distance of transmission in this case was only about 8 miles, but the plant enjoyed the unique distinction not only of beginning American three-phase transmission work but of being part of the splendid system which now covers southern California with its gigantic network.

There had been in the year or two previous some other praiseworthy attempts at energy transmission on the Pacific Coast. At the Falls of the Willamette a couple of years previously some single-phase machines had been installed for lighting Portland, Ore. These generators operated at 3000 volts, each over a separate line, if the writer remembers correctly. Fig. 1 shows the interior of this plant as it was twenty years ago. There was also at Bodie, Cal., an early single-phase transmission system in which two machines of the type and voltage of those in the Portland plant were utilized as generator and synchronous motor respectively.

Fig. 2 is a reproduction of a photograph of the north end of the original Redlands power house, taken about three years ago, quite unchanged from its appearance when the writer first lined up the machine in September, 1893. The remarkable thing about the case is that this particular machine, the old "T Y 10-250-600," is still in service after twenty years at the old stand, playing its regular part in the supply of energy to the system of which it was the beginning and on which it impressed its original frequency of 50 cycles per second. It is a very substantial generator, designed with a large factor of safety, able to carry considerably over its rated load and with a full-load efficiency of 95 per cent. The writer is inclined to think also that this plant was the first polyphase installation in which the machines were regularly run in parallel.

FIG. 1—WILLAMETTE PLANT OF TWENTY YEARS AGO

The story of these early Western plants might serve as a curious text for a sermon on the vicissitudes of electrical equipment and particularly concerning the relation of that sinister and somewhat mysterious thing known as "depreciation" to change in the art. The Portland plant, as shown, went out of existence within two or three years from the date of its installation and was replaced by another plant which itself has in turn been replaced. The single-phase plant was actually installed within three or four years of the practical disappearance of single-phase working for the transmission of energy on any considerable scale. The machines were put out of service when still new with every prospect of a considerable length of life before them. In the next plant use was made of 6000-volt vertical-shaft three-phase generators.

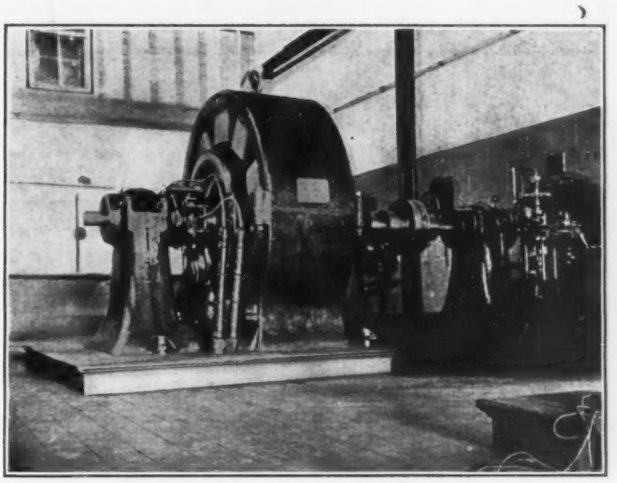


FIG. 2—NORTH END OF REDLANDS POWER HOUSE

The San Antonio Canyon plant, also single-phase, was changed over later, and what has become of the Bodie transmission equipment the writer does not know. Later calls for very much larger output again caused a shifting of the equipment at Portland, so that twenty years have seen practically three equipments at the Falls of the Willamette. The Redlands plant, on the other hand, was a year or two ahead of its time instead of a year or two behind its time, and has gone straight on for twenty years with a probability of a considerable useful life still ahead of it.

There have been some changes in the hydraulic situation, but this is not extended to the three-phase equipment. Probably the thing which has approved it for service so long is in part that the original installation has become one of the contributory generating stations of a large network, being originally developed to fairly near its maximum permissible hydraulic output. There was then no incentive to change by reason of enlarging the original equipment and increasing greatly the size of the units, while in point of efficiency and reliability the original generator has continued to give a good account of itself in spite of increased knowledge of design and a general transition from the revolving-armature to the revolving-field type of machine. The generators of even twenty years ago were built to give long useful life so far as actual physical service was concerned. Their actual depreciation due to change in the art or change in the conditions of suitability has generally been very great. The uncertainty of this phase of the matter is by nothing better shown than the persistence of the original three-phase commercial generator at Redlands as contrasted with the repeated and wholesale changes frequently observed elsewhere. Any engineer may make a shrewd guess at the probable useful life of a physical structure, but it takes a prophet to tell what is going to happen in the way of change enforced by other conditions.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Remarkable Performance of Electric Truck

Five 5-ton electric trucks manufactured by the General Vehicle Company of Chicago have been purchased by the Manhattan Brewing Company of Chicago at different times during the past few months. It is reported that these trucks have been performing work away beyond what they were expected to do. On Aug. 4 one of the 5-ton trucks was driven to South Chicago with a load of thirty-three barrels and two half-barrels, having a total weight of about 6.5 tons. After delivering its load the truck returned to the brewery for a second load, taking out twenty-nine full barrels and eight half-barrels. After conveying this load to its destination, the batteries received a thirty-minute boost, and directly after luncheon a third load of thirty-three full barrels was delivered. The total deliveries for the day with this truck amounted to 100 full barrels, a total weight of approximately 40,000 lb., or 20 tons. The total mileage for the three trips was 64.3 miles, and the reading of the ampere-hour meter at the end of the day's work showed 70 amp-hr. left in the battery, which represents approximately 7 miles of travel. This performance is considered quite remarkable for a 5-ton electric truck, as it shows that it is able to do the work that was formerly considered strictly in the field of gasoline vehicles. All of these trucks are equipped with Edison storage batteries.

Accounting System for Small Lighting Companies

In a paper recently presented before the Arkansas Association of Public Utility Operators, Mr. R. B. Fowles, auditor of the Pine Bluff Corporation of Pine Bluff, Ark., explained the N. E. L. A. system of accounting as it applies to electric-service companies whose gross annual income is less than $25,000. The author stated that in the N. E. L. A. classification accounting is treated under three general heads, namely, operating expenses, operating revenue, and construction accounts. The general head operating expenses is divided as follows: (1) manufacture—operating, (2) manufacture—maintenance, (3) distribution—operating, (4) distribution—maintenance, (5) general expenses.

Operating Expense

The operating expense charges for manufacture include wages, fuel, water, lubricants, waste and miscellaneous power-house expenses and supplies. The maintenance expense charges for manufacture are composed of maintenance of steam plant, maintenance of electric plant, and maintenance of building and fixtures. The charges to maintenance of steam plant should be all expenses of repairing boilers and all their appurtenances, piping to the prime movers, auxiliaries and all repairs to tools other than fire-room tools. Maintenance of electric plant covers repairs to the generators, cables, switchboard and instruments. Under the classification of maintenance of buildings and fixtures are charged all repairs to the power-house building and grounds, including all sheds, stables and the like on the same property.

Operating distribution accounts consist of operating arc lamps, operating meters and transformers, and miscellaneous distribution supplies and expenses. Operating arc lamps covers the cost of trimming, inspecting, testing and repairing arc lamps on the customers' premises and in the shop. Where the central station has the municipal lighting, this account could be separated so as to keep the operation of commercial arc lamps separate from that of municipal arc lamps. Operating meters and transformers includes all costs of setting and removing meters and transformers and connecting and disconnecting services. A small company, however, can dispense with this account, as it probably will not have enough work of this nature to be able to separate it from the other work the linemen or metermen do.

Maintenance of distribution accounts are grouped as follows: maintenance of overhead system, including services, maintenance of arc lamps, maintenance of meters, customers' repairs and renewals. Maintenance of overhead system should be charged with all labor and material in repairing and renewing poles, cross-arms, excavations for poles and similar items. While the text on the N. E. L. A. classification does not state that salaries of linemen and their foremen should be charged to this account, it would be satisfactory to the small company and would give it sufficient cost figures to charge such salaries to this account. Expenses in repairing service wires could very well be charged here and still give the small company all the information it would require regarding the up-keep of the overhead system. If the company supplies energy for the municipal street lighting it might wish to separate this charge in order to secure the cost of maintaining the service rendered the city.

Maintenance of meters covers all cost of repairing and testing meters, including such items as salary of meterman, parts and all miscellaneous expenses in connection with repairing meters and testing, either in the customers' premises or in the shop.

It is the policy of most companies to furnish some service free of charge in order to encourage and stimulate the use of electricity. Where free wiring inside the house, hanging fixtures, installing electrical appliances, etc., is done, any expense occasioned is chargeable to customers' repairs and renewals. This account also includes expenses incurred in attending to complaints of service and in improving the service on the customers' premises.

The general expense item includes commercial and general expenses. These two classes can very readily be combined by the small company. Under this combination are found salaries of general officers, salaries of clerks, printing and stationery, miscellaneous office expense, advertising and soliciting, miscellaneous general expenses, damages, legal expenses, insurance and taxes. Salaries of general officers provide for salaries and expenses of any officer of the company whose jurisdiction extends over the entire property and which cannot be charged to any specific account, such as chairman of the board of directors, president, vice-president, secretary, treasurer and general manager. Under the head of miscellaneous office expense are included sundry supplies, postage, telephone and telegraph service, bond and stock expenses, maps, etc., which are connected with the general office.

The damage account provides for all damages to property and all expenses on account of persons killed or injured through the operation of the plant. These damages include doctors' fees, hospital expenses, claims settled, con-

tributions to hospital funds, accidents to employees and attorneys' fees. Occasionally a company will have to pay a damage claim for the death of a person, perhaps caused by a fallen wire, amounting to several hundred or probably a thousand dollars. If this amount should be charged against the operation of the current month, the earnings would in most small companies be unable to bear the burden. In such cases it would be permissible to open an account in the general ledger entitled "Suspense" or some similar title and charge the payment of the claim to this account. The claim could then be spread out over the operations for several months or years, making a prorated entry each month to the damage account. When the full amount has been closed out from the general ledger to operating expenses, the accumulation of the damage account will show to the management the cost of the damages for the period in hand.

OPERATING REVENUE

The revenue of a small company should be classified as: commercial lighting, commercial motor service, municipal lighting, and profit on miscellaneous sales.

Commercial lighting should be credited with all revenue from consumers for electric lighting, whether by meter or flat rate. It has been found to be of statistical value, however, to keep the metered revenue separated from the flat-rate revenue. When kept in this manner the manager can always determine the revenue per kilowatt-hour for each class of business and know which should be encouraged.

Commercial motor service is credited with the revenue from customers using energy on motor circuits where the energy is registered by a meter separate and independent of the lighting meter. This also includes revenue from flat-rate energy customers. This is a class of business which every electric-light company is anxious to encourage. It is practically a day load, and thus the company can offer a low rate.

To municipal lighting is credited all revenue from the city for lighting the streets and buildings of the municipality.

The N. E. L. A. classification states that the profit on lamps, wiring, appliances and the like should be credited to an account of profit on miscellaneous sales. However, it is the opinion of the writer that this profit should be credited to some expense account, as, for instance, advertising and soliciting, because any expense incurred in handling these items is classed as being an expense for promoting business, and if any profit should result from this work, it would be proper to credit it to the account which bears the expense.

CONSTRUCTION ACCOUNTS

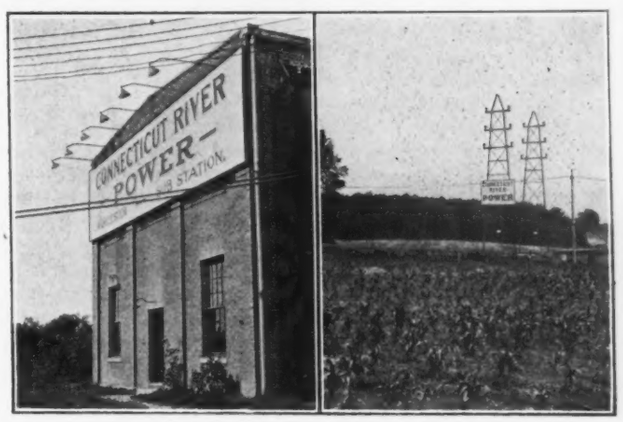
Construction accounts cover all expenditures for extensions to lines, additions to the power house and all betterments which increase the value of the property. A capital charge for construction means that the cost of enlarging a property is placed on the books of the company as an asset and represents the physical value of the system. For this reason a company should be careful that it makes no charge to capital for betterments unless each dollar upon the books has a corresponding value in the plant and equipment. The following accounts should answer the purpose of the small company and should result in concise construction classification: meters, arc lamps, plant extensions, line extension, transformers, furniture and fixtures.

In order to put a classification of accounts into practice it is necessary first to make and adopt the accounts needed for the property. Copies of these should then be circulated among the different departments and some means taken to explain the charges on each account and point out the difference between the several groups. The head of each department understanding the classification would then be able to dispose of the labor and material affecting him. All charges should be made in a thoughtful manner, to insure that the department charged would benefit by the money spent.

The inauguration of such a cost system lays the foundation for a plan of accounting which will furnish accurate data whereupon all estimates of future extensions and additions may be based. It also affords a check upon the operating expenses of each portion of the entire corporation which is reliable and applicable to immediate conditions.

An Effective Hydroelectric Energy Advertisement

Among the hydroelectric corporations of the East which believe in vigorous publicity is the Connecticut River Transmission Company, whose 66,000-volt system now supplies a large portion of central New England, with headquarters and offices at Worcester, Mass. The accompanying photograph shows an 8-ft. by 45-ft. electrically illuminated sign recently installed at the company's Greendale substation, in



FIGS. 1 AND 2—ELECTRIC SIGNS OF CONNECTICUT COMPANY

a manufacturing section of Worcester. The substation is located on a low hill facing two important railway lines and a highway frequented by much automobile traffic. The lighting is provided by six 100-watt, 110-volt tungsten lamps carried in metal reflectors 10 ft. from the wall of the building and about 30 ft. above the ground. The sign is one of the most striking sights in the neighborhood both by day and by night. The second view shows a sign installed by the company on its 66,000-volt steel-tower transmission line at Millbury Junction, near Worcester, at a crossing of the Worcester Consolidated Street Railway and facing the Boston & Albany Railroad's east and west trunk line.

Investigation of Cost of Motor Drive in a Six-Story Factory

In connection with the centralization of the power-plant equipment for a large group of factory buildings an investigation was recently made of the comparative cost of steam and electric operation in a six-story structure used for the production of machinists' supplies. The general methods followed and the data secured are of interest to the solicitor so far as they are available, and indicate the importance of taking as many factors as possible into account in determining the type of motive power to be used in specific instances. As in many cases of this kind, still more complete data would have been desirable, but enough were secured to be suggestive to engineers working in this somewhat specialized field.

The power plant serving the building contained two 200-hp Stirling boilers and two Harrison boilers housed in a boiler room measuring 60 ft. by 75 ft. Hand-firing was employed and the two Stirling boilers, operated at 150 lb.

steam pressure and 100 deg. superheat, were equipped with an automatic fan arranged to reinforce the draft when it fell below a fixed value. The Harrison boilers were much older, and were used only for heating purposes and for operating an elevator pump. In the engine room, measuring 24 ft. by 56 ft., there was installed about ten years before the test a 20-in. by 42-in. Rice & Sargent simple non-condensing engine, delivering about 200 hp at 90 r.p.m. Its exhaust was led to a feed-water heater which raised the feed temperature to 176 deg. Fahr., none of the exhaust being returned again to the boiler. Power was transmitted to the six floors of the building by means of belting and jack shafts. On each floor friction clutches were placed between the line and jack shafts, to permit disconnecting a part of the equipment on the floor when desirable.

Plans for Electrical Operation

In taking up the electrical operation of the installation three different plans were considered. The first was to install one motor of about 300 hp rating to drive the entire mill; the second was to employ individual drive, and the last, to use a group plan of drive. The first was deemed impracticable since the space occupied by the jack shafts and belting would not be available for manufacturing purposes, and since the loss in the jack shafts, which was found to be about 25 per cent of the total load, would not be eliminated. The second plan would have necessitated costly changes in the arrangement of line shafting and called for the abandonment of most of it, besides tending to cause serious interruptions in the operation of the machines. The group-drive plan was considered best for the building, since it would result in no interruption in the service and would eliminate jack shafts and jack-shaft belting.

In order to determine what sizes of motors would be needed on the different floors a 30-hp motor was set up to drive the separate line shafts and the input noted by a Westinghouse curve-drawing wattmeter. As a result of these tests it was decided to install fifteen three-phase, 230-volt induction motors to drive the departments concerned, the total rating being 4380 hp.

Before the steam plant was removed, opportunity was offered to secure data on the operation of the shop by steam. The load on the engine was found by taking indicator cards at frequent intervals throughout three days. Two tests on the steam plant were made, one with the Stirling boilers supplying the engine alone and one with the boilers supplying the auxiliaries and engine. The object of the first test was to obtain the efficiency of the engine and boilers, and of the second, to secure data as to the amount of coal and water used in the boilers to supply steam to the auxiliaries and engine.

Methods of Power Measurement

In order to obtain roughly the power delivered to each of the six floors the following method was used: With all the floors in operation indicator cards were taken at the engine; then the sixth floor was thrown off by means of the clutch connecting the line to the jack shaft, and cards were again taken. The difference between the two engine hp readings was then assumed to be the power delivered to the sixth floor, plus the friction losses due to the transmission to that floor. Then the clutch was again thrown in and the operation repeated for the other floors in turn. The engine efficiency was found to be 10.12 per cent and the boiler efficiency 54.3 per cent in the tests above referred to. The buckwheat coal used cost $3.60 per net ton and was found to contain 12,100 lb.-Fahr. heat units per lb.

With all the machines idle, and with only the shafting load on the engine, the output of the latter was 163.4 indicated hp. The power required to drive the jack shaft, or in other words the shafting and belting from the engine to the clutches on the various floors, was 78.4 hp. The total power delivered to the floors, according to data obtained by throwing out each floor in succession, was 223.4 hp. This, added to the power required to drive the jack shafts, aggregated 301.8 hp.

The determination of the cost of steam power in the installation was made as follows:

Hours of Running:	
(Plant is shut down two weeks for repairs.)	
50 weeks at 5 days of 10 hours and 1 day of 5 hours, less 6 holidays, gives per year, in working hours	2690
Coal used per year in tons, including 119 tons for banking (5 lb. per brake-hp per day)	1664
Water per year, in thousands of gallons	2338
Operating Costs:	
Water per year at 20 cents per 1000 gallons	$467.60
Oil and waste at 0.033 cent per indicated hp-hour	259.40
Ash removal, 399 tons at 25 cents per ton	99.80
Coal per year at $3.60 per ton	5,980.00
Repairs at 2 per cent of investment (see below)	339.00
1 engineer, 50 weeks at $18	900.00
1 assistant engineer at $15	750.00
1 fireman at $12	600.00
Total operating cost with steam	$9,395.80
Investment Costs and Fixed Charges:	
Two 200-hp Stirling boilers (at $13 per hp)	$5,200.00
Feed pump and heater	850.00
Piping	2,000.00
20-in. x 42-in. simple non-condensing engine	8,000.00
Stack, at $2.25 per boiler hp	900.00
Total investment	$16,950.00
Fixed Charges:	
Interest at 5 per cent on $16,950	$847.50
Profit, 10 per cent on $16,950	1,695.00
Insurance and taxes, 2 per cent	339.00
Amortization of boiler, 1.5 per cent, 30-year life	108.00
Amortization of auxiliaries, 3 per cent, 20 years	25.50
Amortization of engine, 1.5 per cent, 30 years	120.00
Amortization of stack, 0.5 per cent, 50 years	4.50
Total	$3,139.50
Grand total steam cost per year, operating expenses and fixed charges	$12,545.30

Determination of Electrical Cost

Cost of Motors:	
3 50-hp motors, 900 r.p.m., at $450.00	$1,350.00
2 35-hp motors, 1200 r.p.m., at $360.00	720.00
2 25-hp motors, 1200 r.p.m., at $301.50	603.00
3 20-hp motors, 1200 r.p.m., at $277.20	831.60
2 15-hp motors, 1200 r.p.m., at $233.10	466.20
1 10-hp motors, 1200 r.p.m., at $201.60	201.60
2 5-hp motors, 1800 r.p.m., at $71.10	142.20
Total, less 10 per cent discount	$3,883.10
(Cost of motors included starting compensators, with motors in service, excluding wiring.)	
Cost of wiring	$200.00
Total cost of electrical installation	4,083.10
Fixed Charges, Electrical Installation:	
Interest, 5 per cent on $4,083.10	$204.20
Profit, 10 per cent on $4,083.10	408.30
Insurance and taxes, 2 per cent	81.70
Depreciation, including repairs and obsolescence, figured at 10 per cent	408.30
Total	$1,102.50
Energy consumption of installation per year, on basis of energy supply to mill directly from central-station mains, requiring 538,650 kw-hr. at 2 cents	$10,733.00
Fixed charges	1,102.50
Total cost of electrical service	$11,875.50
Net saving by use of electric drive, $669.80.	

In this installation the survey indicated that the usual labor economies of the electric drive could not be assumed for the reason that without the complete electrification of the factory group as a whole the existing force would probably be retained. Electricity has been installed in the six-story building, however, and has introduced substantial improvements in the operating conditions, notably in connection with the release of highly valuable real estate for manufacturing purposes and the facilitation of overtime work through subdivision.

Illumination and Wiring

An Electrically Illuminated Tennis Court

A novel installation of electric lighting designed to permit tennis playing at night has been made at the grounds of the Newton Center (Mass.) Squash Tennis Club, bordering the Commonwealth Avenue boulevard. The equipment consists of twenty-four 250-watt tungsten lamps in-

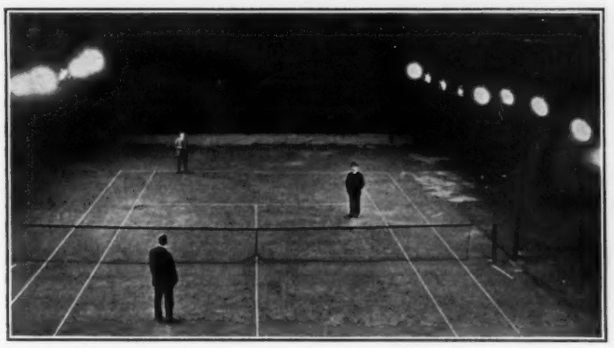
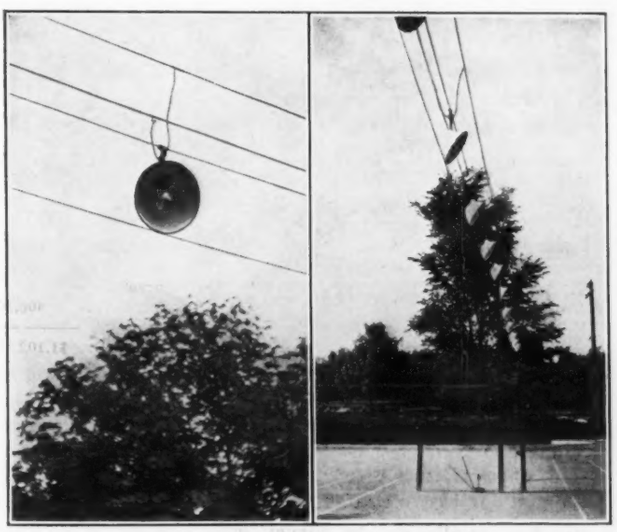


FIG. 1—ELECTRICALLY ILLUMINATED TENNIS COURT

stalled in Holophane type RE No. 486 white-enameled steel parabolic reflectors. These reflectors measure 15¼ in. in diameter and 14 in. deep, the lamps being hung in two rows from messenger cables on the right-hand and left-hand borders of the standard gravel court. The reflectors are enameled outside and in and are secured by clips at their bottoms to a ⅛-in. stranded steel guide wire which prevents swaying in case of wind. The messenger wire is of ¼-in. stranded steel, and the lamps are hung in four groups of six each, each group being supported between two 4-in. by 4-in. North Carolina pine poles. The latter are set in concrete to a depth of about 8 ft. and stand from 14 ft. to 15 ft. above the ground. They are guyed at the ends of the court by ¼-in. stranded steel wire, and the center poles are 18 in. outside the posts supporting the net, all poles



FIGS. 2 AND 3—DETAILS OF LAMP SUSPENSION

being 56 ft. apart parallel to the court axis of play and 45 ft. apart laterally. Experience indicates that 6-in. by 6-in. poles would be preferable in a second installation.

The lamps are supplied with energy through taps dropped off a parallel circuit of No. 8 insulated copper wire, the leads being carried on glass insulators. The lamps are hung 12 ft. to 13 ft. above the court level in catenary suspension and are 8 ft. apart horizontally. Each half of the installation is wired through a common three-pole switch to the regular 110-volt alternating-current secondary distribution circuits of the clubhouse, energy being supplied by the Edison Electric Illuminating Company of Boston. The energy consumption for the area inclosed by the installation is approximately 1.2 watts per sq. ft., and the cost of illumination at the Edison company's regular 10-cent rate is about 60 cents per hour.

In the first few evenings of play a bank at one end of the court was covered with a black cloth, as the ground showed too light and it was not easy to see a swiftly moving ball; but dark gravel has now been substituted and no screening is necessary. The net is black to facilitate play still further. Tournaments in which the best players from outside compete with the local membership are frequently held, and the court is in almost constant demand in the summer evenings. The contractors for the installation were the firm of Deane & Lobdell, Boston. One of the first persons to play upon the court at night was Mr. Earl J. Ovington, the well-known aviator, who states that the illumination is very even, with a soft and diffused light, absence of glare and with generally pitch-black backgrounds. The cost of the installation was approximately $250.

The Development of Rubber-Covered Wire Specifications for House Wiring

By Hugh T. Wreaks

In discussing rubber-covered wire one should consider the characteristics of the copper, the question of tinning and the characteristics of the braid, as well as those of the rubber insulating compound. This is seldom done, however, as there is relatively little disagreement as concerns copper, tinning and braid tests, while there is much difference of opinion in regard to value and function of tests on rubber insulating compounds.

The history of rubber-covered wire specifications is an interesting one and uncovers a problem which has vexed many engineers for a considerable length of time, owing to the great difficulty of determining whether the rubber insulation used will last and whether it will afford an adequate protection against deterioration of the copper underneath. Various attempts have been made to make adulteration impossible by specifications carefully and ingeniously drawn, and these have culminated as regards house wire in the National Electrical Code rubber-covered wire specifications of to-day, which represent the last word on this material.

As of interest, Table No. 1, showing the development of National Electrical Code specifications for house wiring from 1901 to date, and including the New York city specifications of 1910 as really constituting and playing a very active part in this development, is reproduced.

Chemical Analysis

It will be noted that in both the New York City specifications of 1910 and the National Electrical Code of 1911 physical tests were added to previous National Electrical Code specifications, the latter to a greater extent than the former. To both was also added a one-year physical test or guarantee, that of New York City being the same as its initial test and that of the 1911 National Electrical Code allowing for a materially lower value. The Underwriters also introduced a chemical analysis, this latter along lines differing from other previous rubber-compound analyses. Whether this chemical analysis strengthened the specifications is, however, questionable, and the city of New York, while adopting in 1912 the rest of the National Electrical Code specifications, omitted to adopt this chemical test. Relatively it is an expensive test considering the grade of the compound, and theoretically it is supposed to insure 20 per cent of rubber or more in the compound.

Table II indicates how these tests work out in practice, the different letters designating different manufacturers, and the percentage showing the variations in different compounds and the leeway afforded under chemical tests in question.

TABLE I—NATIONAL ELECTRICAL CODE RUBBER-COVERED WIRE SPECIFICATIONS, 1901-1911 INCLUSIVE

0=600-VOLT RUBBER-COMPOUND CHARACTERISTICS

	N. E. Code 1901	N. E. Code 1907	N.E.-N.Y.C. Code 1910	N. E. Code 1911
Thickness insulation wall	3-64 in.—size 14, to 6-64 in.—size 1,000,000 circ. mil.	No change	No change	No change
Physical tests	None	None	Pressure test with wire 0.04 in. diameter at 5 lb. for five minutes. Wrapping test under tension for twenty-four hours around mandrel	Stretch, 2 in.-5 in. Recovery, 2½ in. Final stretch, 6 in. or more
Tensile strength	None	None	As above	400 lb. per sq. in.
Specific gravity	No requirements	No requirements	No requirements	No requirements
Chemical tests	None	None	None	Acetone extract, alcoholic potash extract, chloroform extract, free sulphur and ash determinations shall total by weight 80 per cent or less
Electrical tests, voltage	Tests on 1 ft. samples after seventy-two hours in water, 3,000 volts per 1-64 in. of insulation wall	Additional tests on all coils at factory after twelve hours in water, 1500 volts, one minute, all sizes	No change	Same as before, but with increased voltages for larger sizes up to 2500 volts
Electrical tests, insulation resistance	Sample coils, after thirty days in water, to show at least 100 megohms per mile at 70 deg. Fahr.	Additional tests at factory after twelve hours in water, No. 14—200 megohms, 1,000,000 circ. mil. 100 megohms per mile at 60 deg. Fahr.	No change	Changing of temperature on sample coils from 70 deg. Fahr. to 60 deg. and adjusting factory test values in proportion
General requirements	Rubber or other approved substances	No change	No change	Rubber compound homogeneous in character
Aging tests	None	None	Same as Clause 2 for one year after manufacture	Clause 2 modified Clause 3, the same one year after manufacture

Electrical and Physical Tests

In the specifications will also be found electrical and physical tests which bear the earmarks of higher-grade specifications and which in themselves may or may not mean the 20 per cent rubber as specified.

For a great many years there has been a common impression that because good rubber possessed certain qualities when properly cured compounds which possessed these qualities must of necessity contain a certain given percentage of good rubber. Another common assumption has been that because a compound contained a certain amount of rubber it was bound to have a long life and give good service value. This contention is probably more nearly true than the first, but the facts are difficult to obtain because many compounds which were certified to contain given quantities of pure rubber as indicated by tests have failed in a way that left this assumption open to suspicion.

Concerning the rubber-covered wire as made up to 1911 code specifications, and as certified to by the Underwriters' Laboratories labels, two points are of interest: (1) Will it have a long life and give good service? (2) Does it contain 20 per cent of rubber?

The second question is relatively unimportant, and time will determine the first. However, it may be of interest to analyze its good and bad points. Mechanically the wire must be strong enough to withstand ordinary handling of transportation and installing as well as a certain amount of abuse. Electrically it must be suitable for from 125 volts to 250 volts, and rarely 500 volts, for ordinary house wiring.

The condition of rubber insulation most feared from a point of safety is that of brittleness or drying out, which causes cracks and possible exposure of the copper and is noticeable in a majority of wires, especially at the outlets, after they become from five to twenty years old.

The 1911 code rubber-covered wire specifications have an ample factor of mechanical strength as far as the insulation is concerned, and yet this is really unimportant, because the real strength of a rubber-covered wire lies in the braid, and if this is defective, the rubber will have little value from a mechanical point of view. Electrically there is little change in these specifications from those replaced,

TABLE II—1911 NATIONAL ELECTRICAL CODE SPECIFICATIONS, COMPARATIVE CHEMICAL TESTS

Company Letter	Acetone Extract, per Cent	Chloroform Extract, per Cent	Alcoholic Potash, per Cent	Ash, per Cent	Total Sulphur, per Cent	Total, Five Tests, per Cent
K	13.05	1.30	0.33	56.63	7.74	79.85
BB	2.89	2.85	14.10	23.60	8.50	51.94
V	9.33	2.26	0.70	55.70	7.33	75.32
V	8.40	1.98	4.00	61.30	4.80	80.48
V	9.46	1.51	0.43	61.20	5.77	78.39
A	13.31	2.05	1.10	53.82	8.68	78.96
A	13.54	1.12	1.28	54.27	8.51	78.72
E	8.82	2.53	1.37	58.25	6.04	77.01
C	8.29	3.25	1.40	61.95	4.99	79.88
C	6.88	1.60	0.86	62.92	4.06	76.32
D	10.47	1.80	1.09	57.81	7.49	78.66
B	6.23	5.60	0.95	63.25	4.54	80.57
W	3.57	1.46	1.31	63.19	3.69	73.22
T	10.82	6.81	0.66	53.52	4.87	76.68
Y	8.47	3.16	0.79	59.20	8.84	80.46
Y	7.20	3.70	1.80	59.60	7.14	79.44
Y	7.46	3.24	1.37	58.93	7.13	78.13
R	11.88	2.90	1.05	57.32	3.98	77.13
Q	9.94	1.64	0.56	60.32	4.04	76.50
X	16.08	1.11	0.51	56.42	3.08	77.20
Z	7.24	2.22	0.50	58.30	5.45	73.71
Z	8.59	0.96	0.89	59.40	7.41	77.25
N	15.02	2.56	0.84	57.80	2.56	78.78
N	13.44	2.92	0.75	58.64	2.92	78.67
L	6.00	3.74	1.19	62.15	4.16	77.24

and the factor of safety is ample in each case, barring mechanical injury.

Whether the rubber will dry out or not is, of course, purely speculative, and whether it will dry out faster than that on some of the brands of wire which it replaced must be judged by time.

The physical tests prescribed in the 1911 code specifications call for a stretch before breaking from 2 in. to 6 in. when wire is new, and allow the same wire to stretch only from 2 in. to 4 in. when one year old. This means a physical change or "setting" of this compound from a value of one to three to one to two in one year. If the curve of physical change in the rubber is a normal curve, this one-year change will continue during the second and future years until the condition of non-stretch or drying out has been reached.

Comparing this with the rubber-covered wire of the New York City Code specifications, which it immediately re-

placed, one finds a much smaller original stretch, about 33 per cent, when the wire was new, and a similar stretch at the end of the first year. Theoretically and practically a wire made up under these latter specifications which had little difference in the stretch value between new and one-year-old wire might easily have a curve of deterioration or setting or drying out which at the end of four or five years would show a higher value than the National Electrical Code wire described.

Again, there is a distinct relation between stretch and curing of rubber or vulcanization, and it is conceded that vulcanization continues during the life or aging of the insulated wire. That is to say, compounds contain in themselves a tendency to become more and more cured the older they get. Again, it is claimed that compounds slightly undercured and without qualities of stretch have less tendency toward after-vulcanization or drying out than those with the original stretch and harder cure. In other words, the theory of the latest specifications is to make the physical conditions so high that the drop must be considerable before the compound becomes poor or dead, while those they superseded allowed a lower physical condition with a lesser rate of change.

Judging results from an engineering viewpoint, it is safe to argue that under either specifications some makes of wires will show good service value and others the reverse, while in the long run different makes will doubtless classify about the same. In other words, the making of a compound to meet certain tests is only one feature in the value of the finished product. The way it is mixed and handled, the newness of the rubber material and the vulcanizing and freedom from intentional or accidental adulteration all play an important part.

In a measure, correct drying, mixing, compounding, handling and vulcanizing are indicated in uniformity of tests, physical, electrical and chemical, and the question of adulteration is indicated by price and manufacturer's reputation.

Unfortunately, these two latter forces do not have as full recognition as they should. Rubber-covered house wire today is largely sold with labels of the Underwriters' Laboratories attached, certifying the approval of the Underwriters and being accepted by the trade as evidence that the coils of wire to which they are attached are up to the National Electrical Code specifications and will be accepted by the inspection departments having jurisdiction. Incidentally, this indorsement by the underwriters and inspection departments takes away from the trade any further responsibility and makes difficult any effective criticism in case this wire should deteriorate appreciably within a few years. The entire incentive under pressure of commercial conditions is for a manufacturer to make a wire which will pass all tests when new and show up well for at least one year after.

If the contention of the Underwriters that the drying out of the insulation on the wire in service induces a fire hazard is correct, it would seem that the electrical industry, together with the inspection departments, should frame standards indicating what degree of brittleness of insulation constitutes a hazard. Then any wire failing in such tests would have to be replaced. Probably this rule would affect many installations throughout the country, but it need not be made retroactive. Certainly it would allow a fairer play for manufacturers' reputations than exists to-day and permit an intelligent comparison between first cost of rubber-covered wire and cost per year of service. In the absence of such a clearly defined standard the age of a wire in buildings, generally set for about twenty years, is more often considered a reason for its condemnation than its actual quality.

One point which has not been mentioned is the effect of insulation on the copper. Corrosion from this cause does not appear to be as frequent in house service as in underground service, and when it occurs it causes such obvious trouble that it carries its own remedy with it.

BRAID ON RUBBER-INSULATED WIRE

The braid covering on a wire serves two functions—it adds strength to the wire and compound underneath and it serves as a protector to prevent deterioration of the compound and conductor underneath.

This means that when the braid is exposed to the atmosphere it should withstand temperatures varying from, say, 130 deg. Fahr. to 0 deg. Fahr., or such temperatures as service conditions may require, without any deleterious effect on the braid itself or the preservative and air-excluding compound with which it is saturated. A braid which continually absorbs moisture and then dries out will rot in a relatively short time. The braid should be strong, of good-quality cotton, and flexible enough to protect the conductor during the ordinary process of handling, and if it fills these qualifications it is likely to give a good account of itself in service.

Unfortunately waxes which best exclude water may tend to stiffen the wire and crack the braid when bent, or if put into the braid at a temperature high enough to saturate it thoroughly, may slightly char the braid fiber. Again, those waxes which best withstand high temperature will not best withstand low temperature, although of the two the former is considered more important. Moreover, the strongest braids are not necessarily the most flexible.

To cover these points properly requires specifications which will give the best mean average on points enumerated and which are individualized for different manufacturers' methods. It is wise to make moisture absorption, high and low temperature tests and bending-under-tension tests on braid, and also tests of physical strength whenever the wire may be subject to rough handling. Aging tests on braid could be made with advantage, and their importance made more prominent in specifications.

As pertinent it might not be amiss to quote a series of tests made by Mr. Frank R. Shields at the Massachusetts Institute of Technology several years ago to find some quick means of determining the service value of rubber compounds by exposure for a short time to severe chemical or oxidizing conditions.

These tests were as follows: (a) Exposure of samples bent over tubes so that the rubber surface was under some strain to an atmosphere of ozone generated by oxidation of phosphorus by air; this for varying periods of time and at different temperatures. (b) Exposure of similar samples to an atmosphere of pure oxygen for varying periods and exposed to sunlight. (c) Sun-cracking test, by exposing samples similarly bent to the action of sunlight for varying periods so as to hasten oxidization.

In addition, nitric acid, chromates, permanganates, hydrogen peroxide and acetone peroxide tests were referred to all as powerful oxidizing, or quick aging, agents.

Mr. Shield's conclusions after about two years of experiments were as follows: (1) That the opinion of the majority of engineers, as quoted in different discussions, is not to specify a certain composition for insulation, but to leave it to the manufacturer, the important thing being for the insulation to do the work. (2) That, of the different qualities possessed by insulation, durability is the most difficult to obtain and the most important, and any test to be successful must decide this point, the insulation resistance and dielectric capacity being of varying importance. (3) The ozone test gives results which are practically worthless. (4) There are many reasons for believing that exposure of the samples to the action of sunlight and oxygen under pressure can be made the basis of a reliable and practical test.

The experiments and conclusions of Mr. Shields, which match with those of other engineers and the writer, recognize the difficulty of insuring "service value" in rubber-insulated wire compounds by any known specifications or tests

applied at or shortly after the time of manufacture, and indicate the importance of treating such specifications and tests as only one factor (important if properly applied) and allowing full consideration to the price and reputation or brand of manufacture when attempting to judge the value of the product. In the estimation of the writer, the sooner this viewpoint is recognized the sooner real progress will be made in rubber-covered wire specifications, and the object of inspection and tests then will be to identify recognized brands rather than to call for wire made up under continually changing specifications.

Recent Telephone Patents

Party-Line Devices

It is at times considered advisable on party lines for those using the line to obtain notice of the attempt of a third station to interrupt. According to the invention of Mr. A. Schlosser, of Dodge, Neb., an auxiliary transmitter and gong are included within the set, and in case the hook switch is allowed to rise, the gong is struck through the agency of the auxiliary transmitter, impressing its characteristic tone upon the line.

A harmonic ringer is the subject of a patent granted to Mr. C. J. Erickson, of Chicago. The novelty lies in the method of mounting the clapper rod. This rod is thinned at its lower end to form a reed-like slip. This end is then clamped in a hole in the pole of the polarizing magnet. The armature is slipped onto the clapper rod and held in the proper position by clamping screws.

A lock-out switch for party lines has been patented by Mr. J. G. Roberts, of Chicago, Ill., the patent being assigned to the Western Electric Company. This switch is of the step-by-step type and is operated by a polarized relay, impulses in one direction serving to advance a ratchet switch while an impulse in the second direction withdraws the pawls and permits the switch to return to zero. Each angular position of the switch corresponds to one station.

Letter to the Editors

Waterloo Transformer Connections

To the Editors of the Electrical World:

Sirs:—In connection with the description of the steam plant and substation equipment at Waterloo, Ia., which appeared in the *Electrical World* dated July 26, use was made of a diagram of transformer connections which, although similar in many respects to the connections actually employed, fails to represent the true idea of the method of control devised and installed by the writer. Fig. 1, which is the diagram used in the article referred to, shows two independent systems—a straight open-delta motor service system with the two outside transformers and a straight multiple primary, three-wire-secondary lighting system with the two inside transformers, the two systems not being interconnected in any way but fed from the same three-phase feeder. In Fig. 2 are shown the connections used by the writer. The four transformers are interconnected and operate as a complete unit, from which may be taken energy for three-phase motor service and for three-wire single-phase lighting service. Use is made of standard regulators, which give absolute control of the voltage in either side of the three-wire lighting secondaries. This is the feature of the design that is unique.

An examination of the arrangement of the regulators at *B* and *C* will show that the secondary coil at *C* is reversed with respect to the secondary coil at *B*, whereas the exciting coils have the same sense in both regulators. The result of this arrangement is to cause one regulator to "buck" and the other regulator to "boost" coincidentally, or vice versa. As a matter of fact, use is made of a single regulator having two secondary circuits and one exciting circuit, one of the secondary circuits being reversed when connecting it up.

Normal regulation in the primary lighting phase 1—2 is taken care of by the straight single-phase, double-circuit

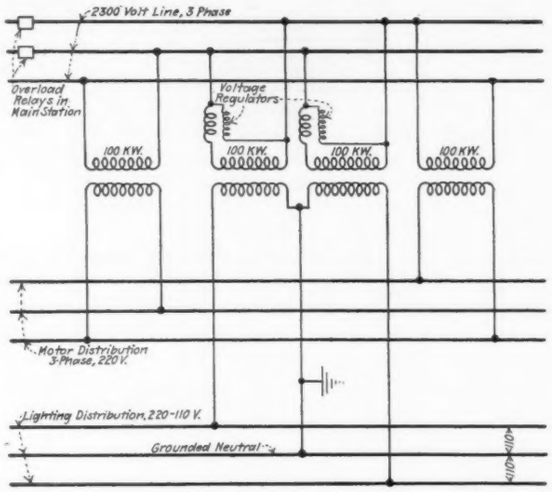


FIG. 1—INCORRECT DIAGRAM OF TRANSFORMER CONNECTIONS

regulator shown at *A*, located at the main station. The purpose of a double-circuit regulator is to boost equally in two of the leads, instead of in only one, thus maintaining a more uniform triangle of voltages.

By placing the regulator secondary *B* in the line feeding energy to transformers 1 and 2 and the secondary of *C* in the line feeding to transformers 3 and 4, one bucking and the other boosting an equal amount, no circulating current can be produced in this system, the principal effect being to control the secondary voltage in transformers 2 and 3 at will.

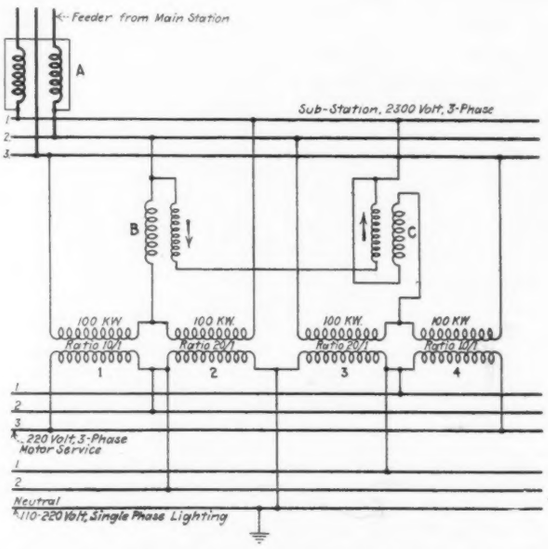


FIG. 2—CONNECTION OF TRANSFORMER BANK TO UNDERGROUND SYSTEM

Merely for the sake of clearness, separate secondary buses are shown for lighting and motor service; as a matter of fact, the neutral bus is added to the three motor-service buses, thus making a single four-wire lighting and power bus, and all of the underground feeders are four-wire, being connected to this one bus.

Waterloo, Ia. Austin Burt.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Heavy Service on a Plant Engine

For the last fourteen years, twenty-two hours a day and 365 days in the year, the Ball & Wood engine in the power plant supplying New York University and the Hall of Fame, University Heights, has been rendering continuous service, furnishing light and power to eight buildings and exhaust-steam heating service to four. These building are scattered over the 37 acres of grounds which make up the campus of New York University. There is no other engine in the power plant so that the university buildings have been altogether dependent upon this unit for service. The present example is of special interest in contrast with the impression prevailing in some quarters that reciprocating machinery of this kind is of limited life. Mr. Galezio, chief engineer of the plant, declares that the engine is still in the best of operating condition and good for many years yet. The original installation was made under the direction of Messrs. McKim, Mead & White, architects, and Pattison Brothers, electrical engineers.

Quick Change-Over from 12,000 Volts to 33,000 Volts

The Gary & Interurban Railway Company holds trackage rights between Hammond and Laporte, Ind., and at present is operating interurban cars over about 20 miles of track as well as the local cars in Gary. A large portion of the energy used in operating these cars was supplied by the Public Service Company of Northern Illinois over a circuit which tapped the electric service company's 12,000-volt line running between Blue Island and Chicago Heights, Ill. The transmission line in the State of Illinois is owned by the Public Service Company, and the section in Indiana is owned by the railway company. One substation of the latter at West Gary, containing two 500-kw rotaries, was fed from this line and supplied energy for the operation of the cars over practically the entire road.

Before the railway company's substation at East Gary was put into operation it was necessary to extend the transmission line and raise the tension to 33,000 volts. The equipment at East Gary consists of two 300-kw rotaries

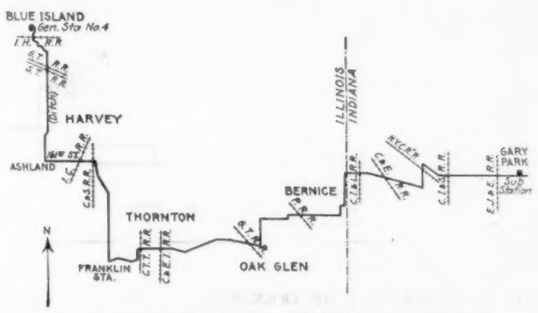


FIG. 1—MAP OF GARY & INTERURBAN SYSTEM

and the accompanying transformers, which are designed to operate on 33,000 volts. As the 1000-kw installation at the 12,000-volt substation in West Gary was carrying a large overload, it was impossible to shift this load over onto a 600-kw station when the change from 12,000 volts to 33,000 volts was made.

Electricity supplied by the Public Service Company to the railway is generated at Blue Island, and two 12,000-volt transmission lines are run between the station and Chicago Heights. For this reason it was considered better practice to install the step-up transformers at the generating station rather than at the point where the railway company's transmission line taps the Public Service Company's lines. Four 3000-kw, 33,000-12,000-volt oil-filled, water-cooled transformers were purchased by the electric-service company, and two of them were connected open delta and installed in a temporary shed outside of the generating station. These transformers were connected through oil

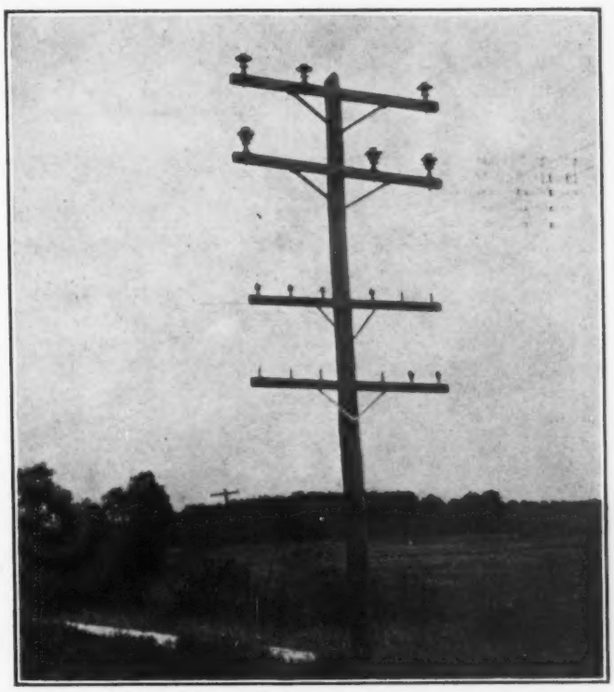


FIG. 2—LINE CONSTRUCTION BETWEEN BLUE ISLAND STATION AND TIE-IN POINT

switches to the station busbars and to a 33,000-volt transmission line which was constructed on the same poles with the 12,000-volt line. The 33,000-volt line was supported below the 12,000-volt line, so that the men could work without hazard in the daytime with the upper line energized. The wires on the new line were strung as far as the tie-in point previously mentioned, and the job of dead-ending and connecting to the railway's line was postponed until the time set for the cut-over.

A 33,000-volt substation was being built by the railway company at Wilkinson, Ind., in which two 300-kw transformers are to be installed. These transformers were brought to the old substation at West Gary and set up in a temporary structure. Connections were made from them to the substation buses and to the transmission line with the necessary disconnecting switches, and the final connections were left open until the line could be de-energized without interrupting the service.

At midnight, one hour before the railway service or-

dinarily ceases, the transmission line was de-energized; the old equipment at West Gary was cut out of service and the final connections on temporary transformers were made. At the same time men stationed at the tie-in point on the Public Service Company's lines dead-ended the 33,000-volt line from Blue Island, erected a buck-arm for a right-angle turn, disconnected the line paralleling the railroad tracks from the 12,000-volt line and connected it to the new 33,000-volt line. While this work was going on tests were made to see that the transformers were installed with proper phase relations and the entire line was tested for stability. Meanwhile the construction men were kept on the grounds so that the connections could be changed back to the 12,000-volt line in case any serious difficulties were encountered. At 4 a.m. the oil switches at Blue Island were closed and the line was energized. No difficulty was experienced in executing the plan, and the line has been working satisfactorily ever since.

The original branch line feeding the railroad having been

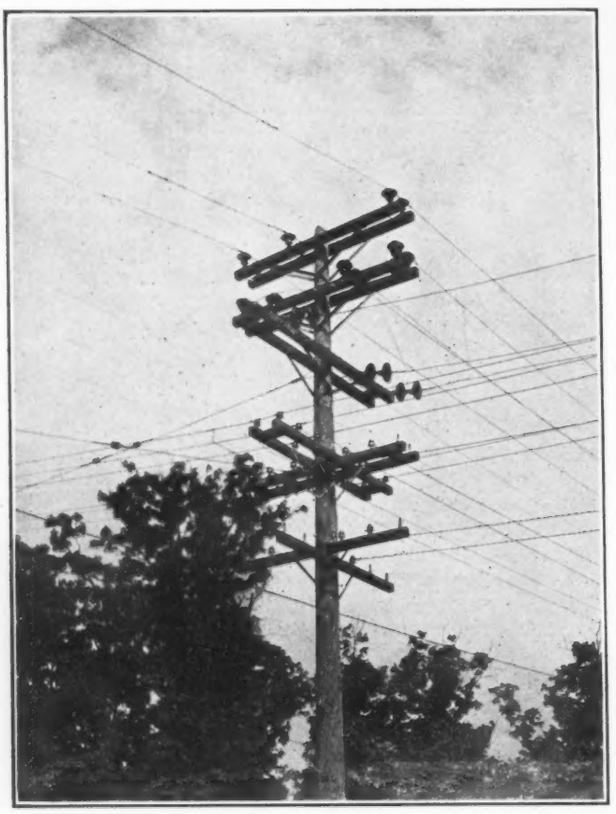


FIG. 3—BUCK-ARM CONSTRUCTION AT TIE-IN POINT

designed for 12,000 volts, a sufficient factor of safety was not left by using the old insulators. This line, which was about 15 miles long, was re-equipped with insulators suitable for 33,000 volts between the hours of 1.30 a.m. and 4.30 a.m. on the nights preceding the final change. During this time the line was de-energized and the men did not have to work under any hazard. In fact the entire work was carried on with careful guard for the lives of the men.

All of the connections and installations which were made during the night on which the line received its first energy at 33,000 volts are not permanent. The line construction is, however. What remains to be done is to rewind the old transformers which were formerly used in the West Gary substation so that they can be used on 33,000 volts. After this is done the transformers which are now being used in the substation will be replaced by those rewound, and the new ones will be installed in the substation at Wilkinson, for which they were originally purchased. An addition is being made on the generating station at Blue Island to receive the 3000-kw transformers when they are permanently installed. As soon as this extension is made two of the four 3000-kw transformers which were purchased by the Public Service Company will be set up and connected in open delta. Between 1:30 and 4:30 a. m., when the energy is not needed, the 33,000-volt line will be shifted over to them from the temporary transformers outside of the station. One of the

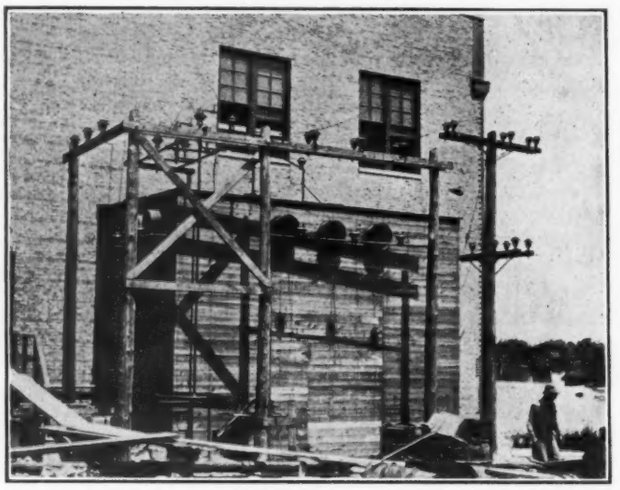


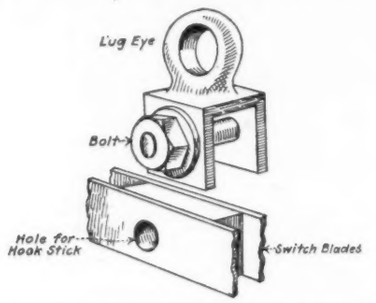
FIG. 4—TEMPORARY TRANSFORMER INSTALLATION AT BLUE ISLAND

temporary transformers will then be connected in the open delta and the system will be in its final form.

The method adopted by the Public Service Company for installing the transformers and converting the system from a 12,000-volt to a 33,000-volt system without any service interruptions is ingenious and worked out well in practice. Mr. J. C. Gapen, engineer of electrical distribution, had charge of the construction, and Mr. Alfred Herz was testing engineer in charge of the final inspection which determined whether the connections were correct.

Extra Eye Lugs for Disconnect Switches

In a certain railway substation the converting equipment consists of three 500-kw, 600-volt rotaries supplied through step-down transformers from a pair of 25,000-volt transmission lines. These supply connections are in duplicate, so that if one line breaks down the load can be transferred to the other by means of a double set of disconnecting switches. The switches have double blades, the holes for



ADDITIONAL LUG AND SWITCH BLADES

the puller hook being drilled through two blades.

The operators, however, experienced difficulty in finding the holes quickly when necessary, so the extra eye lugs illustrated were added. Without changing the switch blades in any way, this lug fits over the blades and is secured by the threaded bolt passing through the original hook-hole in the blades.

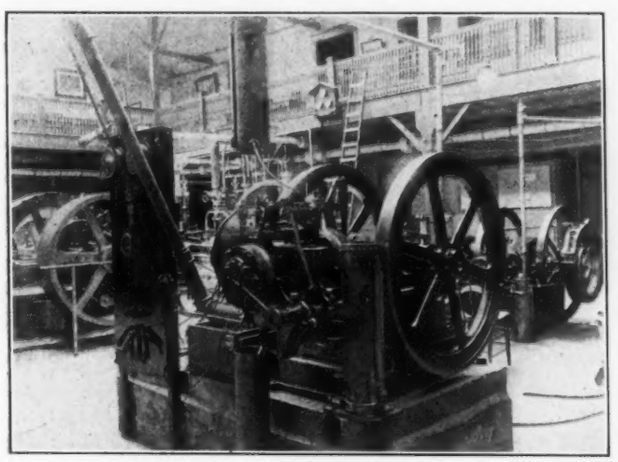
Test of a Kerosene-Oil Engine

BY H. D. WILE

Gasoline engines as prime movers for isolated electric plants are no novelty; but an internal-combustion engine of the ordinary type that can successfully burn any oil of a density over 40 deg. Baumé, run smoothly, and give close enough regulation for electric lighting purposes, deserves recognition. This engine, the Falk kerosene engine, licensed under the Secor-Higgins patents, was tested out in the steam and gas laboratory of the University of Wisconsin.

The engine resembles closely the ordinary four-stroke-cycle, throttling-governor, stationary engine, with mechanically operated valves and make and break ignition. The cam shaft, driven by the crank through a worm gear, working in oil, operates the fuel pump, the governor gear, both valves and the igniter tripper. The gasoline for starting is pumped into the mixer by a hand pump. A 7.5-kw compound-wound generator is directly connected to the engine.

The important part is the mixer, a rectangular box mounted on top of the cylinder, as shown herewith. It is very simple, has no moving parts, and is divided into two compartments—one for fuel and one for water. The fuel and the water are drawn down through special needle valves and atomized by the swift passage of air currents, caused by



KEROSENE-OIL ENGINE UNDER TEST

the suction of the piston. This mixture of oil and water, passing through the double-balanced throttle governor, enters the cylinder through the inlet valve port. The governor is very sensitive, regulating the volume of successive charges in accordance with the conditions of the load.

The engine is easily started and it is necessary only to operate it a very short time on gasoline before feeding it with kerosene, as this system of combustion does not require a hot cylinder to burn the fuel successfully.

Four series of tests were made in the following order: (1) Jacket water temperature; (2) time of ignition; (3) amount of water in cylinder, and (4) economy run.

The results of the first three tests were used in obtaining the settings for the economy runs. The data and results are given in the table. During the runs readings were taken at stated intervals of the gages on the kerosene and the mixer water tanks, the speed, the temperatures of the inlet and outlet jacket water, the amount of jacket water and the electrical load, and an indicator card was taken.

The results of the tests showed that the engine was entirely satisfactory in its operation. It was easy to start, being no more difficult than a gasoline engine of the same size. The most efficient jacket-water temperature was around 175 deg. Fahr., and the best angle of advance of ignition was 36—the average angle for gasoline engines is 16. This would naturally be expected, because kerosene burns more slowly than gasoline. Water is essential in the cylinder of a kerosene engine, as it performs four duties—prevents rapid explosions, excessive pressures and high temperatures, and also prevents the heavy deposit of carbon on the walls of the cylinder. The deposit of carbon after three months of intermittent operation was about the same as would be found in a similar gasoline engine.

TEST OF KEROSENE OIL ENGINE

Cooling water, lb. per hr.	632	445	391	244		
Inlet temperature, deg. Fahr.	47.5	44	71	47.5		
Outlet temperature, deg. Fahr.	106	123	157	182		
R.p.m.	448	448	449	446		
Brake-hp.	9.05	9.05	8.73	9.05		
Indicated hp.	11.04	11.31	10.65	11.84		
Mechanical efficiency, per cent.	82	80	82	76		
Kerosene, lb. per bhp-hr.	1.14	1.09	0.98	1.0		
Thermal efficiency	11.2	11.7	13.1	12.8		
Angle ignition, deg.		34	38	41		
R.p.m.		446	450	442		
Brake-hp.		8.73	9.05	8.73		
Indicated hp.		11.7	10.65	12.0		
Mechanical efficiency		77	82	75		
Kerosene, lb. per bhp-hr.		0.97	0.98	0.95		
Thermal efficiency		13.2	13.1	13.4		
Mixer water-kerosene, per cent.		34.4	62.8	85		
R.p.m.		442	440	444		
Brake-hp.		8.7	8.7	8.7		
Indicated hp.		12.3	11.7	11.4		
Mechanical efficiency		71	74	76.7		
Kerosene, lb. per bhp-hr.		1.06	1.14	1.19		
Thermal efficiency		12	11.1	10.5		
Brake-hp.	4.2	5.5	7	8.73	10.3	11.9
Indicated hp.	6.4	7.5	9.17	11.2	12.5	14.38
R.p.m.	457	457	450	448	437	436
Mechanical efficiency	66	74	76	77	82.5	82.8
Cooling water, lb. per hr.	236	290	306	262	309	304
Kerosene, lb. per bhp-hr.	1.55	1.26	1.05	0.93	0.87	0.94
Thermal efficiency	7.3	10.1	12.1	13.8	14.7	13.6
Maximum pressure, lb. per sq. in.	68	94	124	170	206	242

Some of the interesting points brought out in this test were that the best ratio of kerosene to water in the mixer was as three to one, and that the addition of more water decreased the thermal efficiency; that the percentage of heat absorbed by the jacket water was approximately 16 per cent, and the heat lost in radiation and exhaust was approximately 55 per cent. This differs widely from gasoline-engine practice, where 40 per cent of the energy in the fuel is absorbed by the jacket and 30 per cent lost through the exhaust. The fuel economy was good, 0.872 lb. kerosene per brake-hp-hr being the lowest. The tests show that non-volatile or low-grade fuels can be burned successfully in small units.

Assuming kerosene at 10 cents a gallon, the fuel cost in operating this outfit according to the test would be 2.1 cents per kw-hr. By using a cheaper grade of oil and purchasing it in large quantities, this cost may be cut 40 per cent.

Half-Speed Generator Operation

Can a 120-volt direct-current generator be operated at one-half speed to produce 60 volts? J. H.

When separately excited the voltage produced by a direct-current generator varies directly with the speed and at half-speed has one-half full-speed value. Since an emf of 60 volts is insufficient for exciting a 120-volt generator, this machine would not be self-exciting at one-half speed. However, by dividing the field coils into two equal parts and connecting these in parallel instead of series the current in each field coil will be the same as formerly and the operation should be satisfactory, provided the field circuit rheostat is arranged to withstand double current strength. The voltage being lowered to one-half, the total field current doubled, and the permissible armature current not increased, the permissible output is somewhat less than 50 per cent of the original value.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Definition of Rotation of Phases in Alternating-Current Diagrams.—Strecker quotes the rule adopted by the International Electrical Congress in 1911 in Turin as to the definition of sense of rotation of phases in alternating-current diagrams, and refers to the fact that considerable opposition to this definition has manifested itself among German engineers. The matter is, therefore, now subjected to a thorough discussion. H. Goerges summarizes the arguments which can be raised against the rule of the International Electrical Congress, while E. Breisig and K. W. Wagner summarize the arguments for the commission. The discussion is to be continued.—*Elek. Zeit.*, July 31, 1913.

Commutation Theory.—M. Latour.—Some notes on commutation in the really neutral zone. He refers to his theory pronounced in 1902 and explains how the mixing up of two different explanations of the same thing has led to curious misunderstandings. With Richter he is now in complete agreement. As to Menges' theory, the present author considers it to be an "exaggeration" of his own theory which he cannot accept.—*Elek. u. Masch.* (Vienna), July 27, 1913.

Commutation of Repulsion Motors.—M. Liwschitz.—In order to reduce the detrimental effect of the emf of transformation in repulsion motors, the author connects the short-circuited windings in opposition to each with respect to the emf of transformation. By this means the formation of sparks at the commutator is diminished not only during normal operation but during starting.—*Elek. u. Masch.* (Vienna), Aug. 3, 1913.

Lamps and Lighting

Street-Lighting Specifications.—A long editorial reviewing the recent report of the committee of the National Electric Light Association on street lighting and comparing its conclusions with those of the recent joint British committee of the Illuminating Engineering Society and others. The American specification would consist of a study by an engineer who would be responsible for the whole scheme. He would determine what illumination was necessary and what lamps should be used, how they should be spaced and at what height, etc. He would then draw up a specification and rely upon candle-power measurements to see that his specification had been carried out. The specification submitted by the British committee, although it would not preclude the specifying of details, would render necessary only the specifying of minimum illumination in all the more important contracts. The present writer thinks that whether we can depend upon the measurement of illumination for a specification of this kind is largely a question of accuracy. Engineers are accustomed to the measurement of candle-power; they are not so used to the measurement of illumination. There is a doubt in the minds of many whether illumination measurements can be made with sufficient accuracy for the purpose.—London *Electrician*, Aug. 1, 1913.

Church Lighting.—An illustrated article on the electric lighting of Westminster Abbey in London. The electroliers in the main body of the building are six-lamp and four-lamp fittings, provided with 50-watt, 220-volt metal-filament lamps. These lamps being supplied with energy at 200 volts, about 10 per cent below their rated voltage, will have substantially increased life; at the same time they give a more subdued tint to the light, thereby providing the restful effect necessary in church illumination. The main part of the building, the nave, is illuminated by two rows of eight six-lamp electroliers suspended from the roof by composite cables of steel wire surrounded by the necessary electric leads. These are spaced 18.5 ft. apart and 13.5 ft. above floor level.—London *Electrician*, Aug. 1, 1913.

Incandescent Lamps—M. von Pirani.—The author sketches the development of the modern incandescent lamp from the carbon lamp, osmium lamp, Nernst lamp, tantalum lamp to the tungsten lamp with squirted filament and with drawn filament. Fig. 1 shows four different scales giving for a normal 1.1-watt-per-hefner-candle-power lamp the

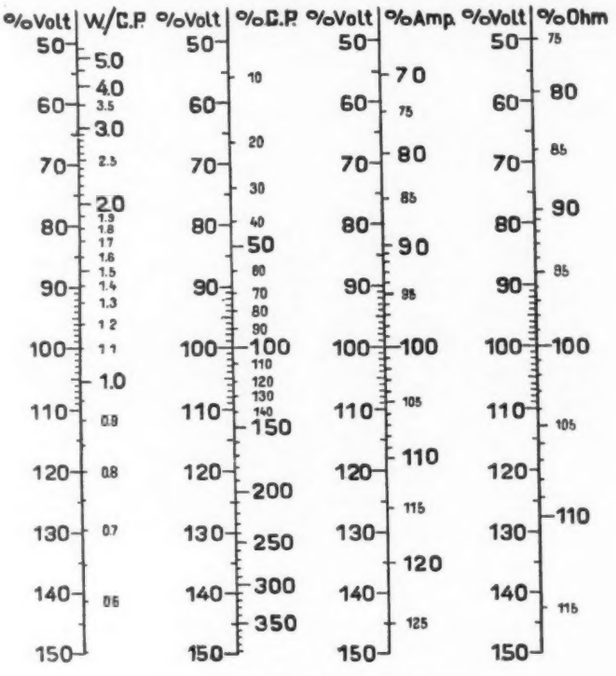


FIG. 1—SCALES OF LAMP VALUES

watts per candle-power as a function of the voltage, the amperes as a function of the voltage, and the ohms as a function of the voltage, respectively. The values are marked 100 per cent for the conditions under which the lamp consumes 1.1 watt per hefner candle. For instance, increasing the voltage by 10 per cent above normal raises the candle-power by 39 per cent and raises the amperes by 5.6 per cent, so that the watt per candle-power is reduced to 0.92.—*Mitteilungen a. d. Ges. Siemens & Halske, Siemens-Schuckertwerke*, Vol. I, No. 1, July, 1913.

Alternating-Current Metallic-Filament Lamps.—A. Larsen.—An illustrated English translation in abstract of his German paper recently noticed in the *Digest* on a new experimental method for determining the fluctuation of light from a metallic-filament lamp during half a cycle.—London *Electrician*, Aug. 1, 1913.

Traction

Freight Locomotive.—R. Richter.—An illustrated description of the regulation of the electric freight locomotive built by the Schwartzkoff company for the Prussian

State Railways. The speed of the motor is controlled by means of an induction regulator in connection with a step transformer. The induction regulator is operated by compressed air. The motor has two separate armature windings which are connected in series through the commutators. The commutators are arranged at both sides of the armature so that the design is perfectly symmetrical, and an excellent cooling action is obtained. The main advantage of the two armature windings is, however, the reduction of the armature current to one-half of the value in a motor with the same emf at rest between adjoining commutator segments and with only one commutator. This result is important since it permits the use of comparatively cheap and safe switching arrangements.—*Elek. Zeit.*, July 31, 1913.

Installations, Systems and Appliances

Ventilation of Buildings.—J. W. MEARES.—A paper in abstract presented before the Calcutta section of the (British) Institution of Electrical Engineers. The author emphasizes the advantages of hollow-wall construction of buildings in tropical countries, with the modification that, in place of an ordinary still-air jacket, artificially cooled air is circulated between the inner and outer walls by means of an exhaust fan, the cooling being effected by drawing the current of air through a wetted screen or other contrivance such as is described in this paper.—London *Electrician*, Aug. 1, 1913.

Electricity Supply in Jersey.—A note stating that the gas company of the city of St. Heliers, on the island of Jersey, in England, intends to erect an electric station. Energy is to be sold at 10 cents per kw-hr. for residential lighting, 9 cents for business lighting, 3 cents for motor service and heat, with special rates for large consumers. A three-wire system is to be used, with 240 volts for lighting and 480 volts for motor service. For the present there will be installed two sets of 200-kw rating, and there will be a large battery of accumulators, which is to be capable of dealing with the entire supply for a prolonged period.—London *Electrician*, July 25, 1913.

Burton-upon-Trent.—An illustrated article on recent electricity extensions at Burton-upon-Trent. It includes the provision of turbo-generating plant and the installation of a motor-generator link with the existing single-phase supply and a rotary-converter to link up the direct-current railway supply with the new three-phase generating plant.—London *Elec. Review*, July 25, 1913.

Wires, Wiring and Conduits

Alternating-Current Conductors for Heavy Currents.—MICHALKE.—The author discusses the difficulties in the design of conductors and switches for carrying very heavy alternating currents. The enlargement of the conductor cross-section is impaired by the skin effect. When subdividing a thick conductor into a number of conductors in parallel, there is trouble due to non-uniformity of distribution of the current over the different conductors and therefore non-uniformity of temperature. The author describes suitable arrangements by which these troubles can be overcome. For instance, the formation of non-symmetrical magnetic fields with their resulting troublesome induction effects is avoided by mixing up the conductors carrying the three currents (*a, b, c* respectively) of a three-phase system, according to the following scheme:

a b c a b c
b c a b c a
c a b c a b
b c a b c a
a b c a b c

This arrangement also reduces the inductive voltage drop. The author finally describes the construction of a 4000-amp overload circuit-breaker for three-phase currents.—*Mitteilungen Siemens & Halske*, Vol. I, No. 1, July, 1913.

Dielectric Measurements of Cables.—M. KLEIN.—The first part of a paper in which the author gives the result of systematic tests of the perforation voltage of cables. A distinction should be made between perforation strength in general and the degree of safety of the cable. The former depends on the mean value of the results, while the degree of safety is the ratio of the minimum observed perforation voltage to the voltage of operation. A single-conductor head cable was used for the tests, and in order to determine the influence of conductor cross-section and insulation thickness cables were built for three conductor cross-sections (q = 16, 50 and 240 sq. mm) and for two thicknesses of insulation (3 mm and 6 mm). Otherwise the different cables were made as uniform as possible; the same quality of paper was used for all of them, they were dried in the same oven, and were impregnated with the same kind of material. The cables were divided into equal sections and these were tested. In all of the tests the voltage was increased from an initial low value at equal intervals by equal amounts. The results of the tests are given in the following table:

PERFORATION EMF IN KILOVOLTS	INSULATION THICKNESS					
	3 MM			6 MM		
q=conductor cross-section in sq. mm.:	16	50	240	16	50	240
20 to 30	1	2	3	..	..	..
30 to 40	22	35	41	2	2	..
40 to 50	47	28	21	3	11	..
50 to 60	..	..	5	33	11	5
60 to 70	..	..	..	26	33	26
70 to 80	..	..	..	1	18	27
80 to 90	..	..	..	..	5	19
90 to 100	..	..	..	..	..	3

As was to be expected, the perforation voltage varied between rather wide limits, although the mean values follow certain rules. The paper used for insulation was specially tested and was found to be practically perfect. The results of the tests showed the approximate correctness of the O'Gorman law with the exception that the specific perforation strength increases somewhat with decreasing copper cross-section. Tests made with heated cables show that the perforation strength certainly does not decrease with increased temperature. For the cables tested the no-load power-factor tends to approach a limiting value with increased voltage and reaches this limiting value the more quickly the greater the copper cross-section and the insulation thickness of the cable. In connection with the loss determinations a zero method is described which may be used as a basis for the design of sufficiently sensitive needle instruments for measuring the dielectric losses of cables.—*Elek. Zeit.*, July 24 and 31, 1913.

Electrophysics and Magnetism

Volta Effect.—A. E. HENNINGS.—An account of an experimental investigation of the nature of the Volta effect. The Volta effect depends, under all circumstances, on the nature of the opposing surfaces of conductors which have been brought near, or in contact with, each other. Indeed it depends only on the surfaces exposed to and within range of each other. All, and only, such surfaces or portions of surfaces of conductors contribute to the general effect. The results of experiments purporting to prove otherwise are spurious. Hence Sanford's recent chief argument against an electrolytic theory of the Volta effect fails because of a misapprehension in the premises. The surfaces of con-

ductors which have been discharged to earth act just as though they were definitely and characteristically charged. In the case of a homogeneous surface, this postulated electrification is uniformly distributed, while for a surface of dissimilar parts its nature and intensity vary from part to part. The surfaces being the seat of such electrical manifestations exhibit, as a consequence, a definite potential difference, the so-called emf of contact, between each other. It is only in terms of these potential differences that the phenomenon lends itself to quantititave treatment. The effect observed with composite surfaces has been shown to be the average effect of the constituent parts, each of which contributes in exact proportion to its extent, its relative proximiy and its own potential difference with reference to the opposing surface. The effect is practically compietely "screened" when the lateral dimensions of the openings in the screen are not greater than their depth. An increase in the ratio from unity upward between the width and depth of the holes results in an increasing effect through the openings. Taken as a whole, the results show that the phenomenon has its seat in the surface. The fundamental question, then, reduces to one in regard to the actual conditions on the surface of a conductor. Is there an insulated electric layer brought into existence by chemical or other means, or are the manifestations due to intrinsic properties of the conductor which make themselves felt at its boundaries? This question is still an open one so far as the present investigation goes.—*Phys. Review,* July, 1913.

Condenser Discharges.—J. A. Fleming.—An abstract of a (British) Physical Society paper in which the author discusses the discharge of a condenser through an inductive circuit and gives oscillograms which confirm the theory qualitatively and quantitatively. He then passes over to the discussion of coupled oscillatory circuits and gives diagrams which show the effect of gradually increasing the coupling of two inductively coupled circuits and thus creating in the oscillation trains beats indicating the presence of two frequencies.—London *Electrician,* July 25, 1913.

Transmission of Canal Rays.—A. N. Goldsmith.—An account of an experimental investigation of the transmission of canal rays through thin partitions. Canal rays made up of ions of hydrogen or helium can have sufficient velocity given them to cause them to pass through a thin material partition. When the discharge tube is filled with air, carbon dioxide or argon the only rays that pass through a thin partition are hydrogen. When helium is used both helium and hydrogen atoms pass through the partition, the helium in great abundance. When hydrogen is used only hydrogen atoms pass through the partition, and these in large quantities. The atoms which pass through such a partition are not capable of causing fluorescence on screens.—*Phys. Review,* July, 1913.

Electrochemistry and Batteries

Hypochlorite Disinfectant.—A note on last year's report of the medical officer of health of the borough of Poplar on the use of hypochlorite for disinfecting purposes. The fluid, prepared by the electrolysis of a saturated solution of chloride of magnesium, with a proportionate amount of salt and caustic soda, is manufactured by the borough plant at a total cost of $10 per 1000 gal., including the cost of electricity at 3 cents per kw-hr., the chemical materials and the water. The use of the disinfectant for the year amounted to 54,388 gal., rising from a minimum of 1400 gal. for January to a maximum of 8610 gal. for the month of July, in which month and other summer months the fluid is in use for the public baths. Since the plant has been installed, nearly 250,000 gal. has been manufactured, at a total cost of $2,400, the cost of electricity being 57 per cent of this amount. The Public Health Department is credited with 2 cents per gallon for the fluid supplied to the work department. Four elementary schools were supplied with 960 gal. for spraying and floor-cleansing purposes. For public bath purposes a 39,000-gal. bath receives an initial dose of 10 gal. of fluid, and subsequent additions at two-day or three-day intervals, according to the condition of the water, the water being changed at periods of from seven to ten days. The fluid is used in connection with baths, not with a view to the economy of water by less frequent refillings, but to provide a clean and invigorating bath for bathers. The water, it is found, becomes purified both chemically and bacteriologically by the oxidizing and germicidal properties of the fluid.—London *Electrician,* July 25, 1913.

Units, Measurements and Instruments

Alternating-Current Potentiometer for Measuring Telephone Currents.—C. V. Drysdale.—An illustrated article in which, after giving a description of the alternating-current potentiometer, the author describes its application to telegraph and telephone measurements, such as attenuation constants and polar diagrams showing the distribution of potential difference and current in telephone cables. Applications are also suggested in radio-telegraphy. The principle of the alternating-current potentiometer is shown in Fig. 2. It is that of balancing any sinusoidal alternating potential difference to be tested by a potential difference of equal magnitude and phase derived from the potentiometer. This is attained by feeding an ordinary potentiometer (wound with coils of the smallest possible inductance and capacity) with current derived from the secondary of a

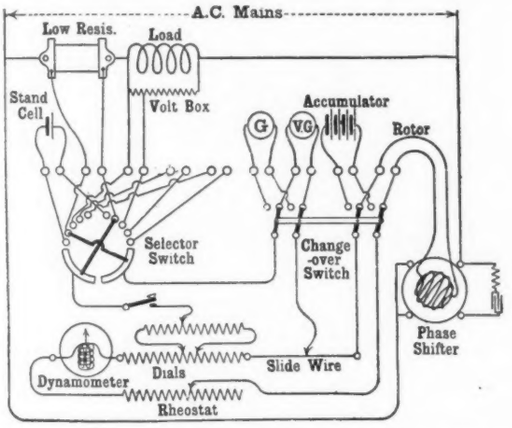


FIG. 2—POTENTIOMETER FOR TELEPHONE CURRENTS

phase-shifting transformer, which turns in a rotating field generated from the supply mains by "splitting the phase." The movement of the ordinary potentiometer slides alters the magnitude of the potential difference between them in the usual way, while the turning of the secondary of the phase-shifting transformer through any given angle alters the phase of the potential difference by precisely the same angle. In order to obtain the magnitude and phase of any alternating potential difference it is, therefore, necessary merely to balance it in the same manner as in the case of a direct potential difference, except that a vibration galvanometer, telephone or other alternating-current detector is substituted for the ordinary galvanometer, and that balance is secured by the two processes of turning the phase-shifter secondary as well as altering the potentiometer slides. As soon as balance is obtained the potential difference to be measured is read off both in magnitude and in phase, or as a vector, by the indications of the potentiometer and phase-shifter dials.—London *Electrician,* Aug. 1, 1913.

Telegraphy, Telephony and Signals

Semi-Automatic Telephone Exchange.—An illustrated description of the new semi-automatic telephone exchange of the city of Posen, Germany. This replaces the old hand-operated exchange, the capacity of which had reached its limit. The new exchange was opened last July with 3200

connections, and 800 more connections have recently been added. The final connections will number 10,000—*Mitteilungen Siemens & Halske,* Vol. I, No. 1, July, 1913.

High-Frequency Oscillations from Direct-Current.—WILLIAM I. BOOK.—A description of a new method for producing electric oscillations of high frequency from a direct-current source. The converter consists of a powerful electromagnet with heavy tubular pole pieces, *a* (Fig. 3). The walls of these pole pieces are reamed out, or tapered, at the end. Fitted on the end of each of these pole pieces is a fiber ring, *b*. To this fiber insulation is attached a copper (cathode) ring, *r*. One of the tubular pole-pieces is filled with a plug of fiber, *c*. A brass rod, *d*, neatly fits into a longitudinal hole through the center of this fiber plug. This rod is thus insulated from the pole pieces. There is fastened to the end of this rod by means of a machine screw a zinc or carbon (anode) disk, *e*. The faces of the fiber rings, mentioned above, project slightly beyond the ends of the pole pieces, making sockets into which are fitted disks of mica, *g*, over the ends of the pole pieces. These mica disks with the fiber rings insulate both the anode disk and the cathode ring from the pole pieces. If an emf of 500 volts is impressed across the gap between the anode disk and the cathode ring, which has a regularly roughened or notched surface, a spark discharge will take place and by the action of the magnetic field this discharge is made to move around and ground the circular gap. In Fig. 4 there is shown a general diagram of the connections of the apparatus. The source of difference of potentials used, *e*, was two ¼-hp, 500-volt direct-current generators jointed in parallel. R_0 is a resistor of variable resistance consisting of a bank of carbon-filament lamps in series with a slide-wire contact resistor capable of carrying the main current from about 0.1 amp to about 1 amp. I_0 is a direct-current milliammeter with which to measure the current in the main circuit. L_0 is a choke coil. *G* is the gap between the anode disk and the cathode ring. C_1 is a condenser of variable capacity in oil. C_2 is a similar condenser in the secondary oscillating circuit. L_1 is the primary of a closely wound induction coil. L_2 is the secondary of this coil. I_1 is a hot-wire ammeter with which to measure the current in the primary oscillating circuit. R_2 is a resistor of variable resistance consisting of a bank of carbon-filament lamps. Because of the notches or grooves in the outside cathode ring the sparking distance alternates rapidly from a given minimum to a given maximum as the discharge passes around the gap, and, therefore, the resistance of the gap likewise varies with this varying length. The choke coil maintains a constant supply of energy, but on account of the notched surface of the cathode ring the length of the spark-gap and its resistance vary periodically so that there is rapidly alternating flow and ebb of energy into the primary circuit. The author discusses the effect which the different conditions have on the production of oscillations and notes the application of this converter in wireless telegraphy and telephony.—*Phys. Review,* July, 1913.

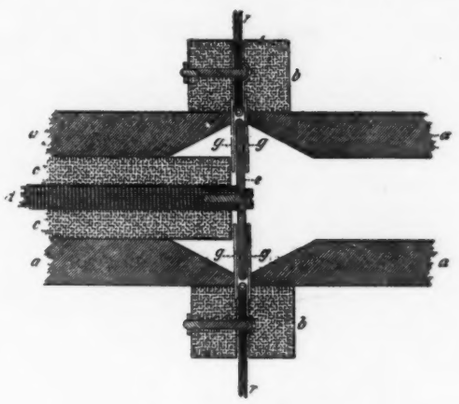


FIG. 3—CONVERTER

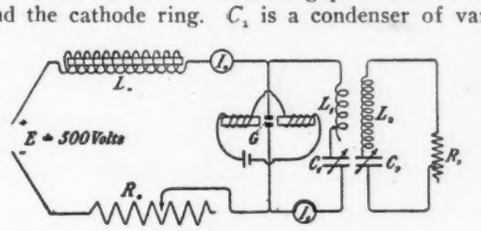


FIG. 4—DIAGRAM OF CONNECTIONS

Book Review

A HANDBOOK OF WIRELESS TELEGRAPHY. Its Theory and Practice. By James Erskine-Murray, D. Sc. Fourth edition, revised and enlarged. New York: D. Appleton & Company. 442 pages, 195 illus., 11 tables. Price, $3.

The fourth edition of Dr. Erskine-Murray's "Handbook" will be welcomed, since in it the author connects recent experimental data with several of the old problems of radio transmission and, in his characteristically clear manner, discusses the newer developments of sparks and sustained wave transmitters. The material of the 1911 edition has been revised and largely supplemented, the new data concerning high-power Marconi stations being of especial interest. Although there are given many design details of the instruments used in the early years of wireless signaling, the book cannot be considered a completely descriptive treatise, since the most significant and useful portions are the lengthy quotations from reports of numerous researches by various experimenters and Dr. Erskine-Murray's interpreting comments and discussions thereon. The consideration given to the electrical design of antenna systems is especially worth noting, since the permissible deductions from many years' labor are crystallized and cleanly set forth. Likewise the discussions of "hump-wound" oscillation transformers and the relative importance of static and magnetic transfer of energy in their several forms are of much interest. It is not likely that all the conclusions in respect to the theory of transmission (which is the subject of a long chapter containing much new material) will be generally accepted by radio engineers, especially since consideration of what appear to be reflection-interference effects is very brief. The new chapter on the telegraphic efficiency of a pair of radio stations, in which there are differentiated the efficiencies of energy transmission, of signal transmission and of operation, contains a number of very practical suggestions which should help to put into more general use intelligent methods of traffic engineering. In the future editions of this handbook a little more care might be given in the scrutiny of statements concerning the practical achievements of various types of radio apparatus. From page 126 one would gain the impression that electrolytic anti-coherers of the "bridge-breaking" type are in common use at present, though actually the few that were installed in commercial radio plants have been replaced by instruments of the rectifier type. On page 208 the statement that 35 kw of power has proved sufficient for regular working between Honolulu and San Francisco by the arc method leads one to believe that commercial communication is maintained by daylight, but evidence adduced during the Marconi investigation in England throws this into grave doubt. These matters, however, are really trifling when contrasted with the high standard set by the book as a whole, and the author is to be congratulated on his further modernizing of a volume without which no radio engineer is satisfied to remain.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Temporary Lamp Receptacle

The receptacle herewith illustrated has been designed primarily for temporary work. It can easily be connected in circuit, because it is unnecessary to strip the insulation from the wire. The wire is placed opposite the screw,

TEMPORARY LAMP RECEPTACLE

which is then tightened so that the point at the end will puncture the insulation and make contact. This receptacle is made of mica compound and will withstand rough handling. It has been placed on the market by Pass & Seymour, Inc., Solvay, N. Y.

Tests of Wooden Poles Reinforced at Ground Line

Some interesting tests were conducted in Pittsburgh on July 30 and 31 by the Pittsburgh Reinforcing Pole Company to determine the break-down limits of poles which had been equipped with its Orr reinforcing collar. In this system of prolonging the useful life of a wooden pole, a collar and sleeve of concrete reinforced with rods and expanded metal are applied at the ground line—the part which is most subject to decay. The poles under test comprised five 40-ft. and ten 30-ft. chestnut and ten 30-ft. cedar poles which a certain large company had reinforced several months before in accordance with the manufacturer's specifications.

When tested, the cedar poles broke off above the reinforcing collar at an average pull of 2000 lb., and the chestnuts at an average pull of 3000 lb. The load was applied 30 ft. above ground on the 40-ft. poles and 19 ft. above ground on the 30-ft. poles. The ultimate strength of the reinforcement was satisfactory, but in nearly every case cracks developed in the concrete collars at 1500 lb. The customer expressed the opinion, however, that a steel and concrete reinforcement should be able to withstand a pull of 2000 lb. under similar conditions without developing cracks in the concrete. The poles for the second test were therefore reinforced to meet this requirement by substituting a heavier expanded metal and by adding 1 in. to the thickness of the concrete in the collars and sleeves.

Under test, five of the strengthened 40-ft. poles withstood an average pull equivalent to 2335 lb. applied 30 ft. from the ground before developing any cracks in the collars and withstood a pull of 3040 lb. before failure. In three cases the upper part of the poles split or broke. Six 30-ft. poles withstood an average load equivalent to 2444 lb. with a 19-ft. lever arm before developing cracks in the collar, and 2961 lb. before failure.

The average load on the base of the 40-ft. poles was 91,000 lb.-ft. at the time of failure. Eight rods were used in these, and four rods in the 30-ft. pole, which withstood 57,000 lb.-ft. As both sizes had the same weight of expanded metal and approximately the same thickness of concrete in the sleeve and collar, the better results on the 40-ft. reinforcements were undoubtedly due to the extra rods. Two poles similarly reinforced were saved to be broken later.

Eight other reinforced poles were broken on which reinforcing rods lighter and shorter than the standard rod were used, so that a thorough experimental test of the reinforcement was obtained.

FIG. 1—CRACKING OF REINFORCEMENT UNDER EXCESSIVE LOADING

FIG. 2—REINFORCEMENT SURVIVING THE BREAKAGE OF POLE TO WHICH IT WAS APPLIED

Details of Material and Conditions of Test

The poles were new class B chestnuts, artificially weakened by reducing a section extending 15 in. below the ground to 29 in. in circumference on the 40-ft. and from

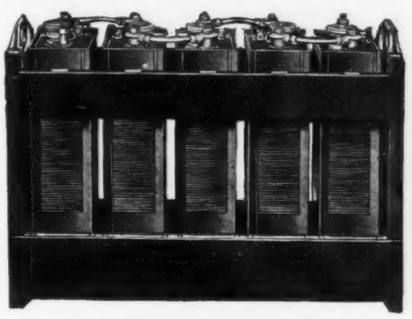
25 in. to 25.5 in. on the 30-ft. poles. The original circumference 6 ft. from the butt was between 43 in. and 47 in. on the 40-ft. poles and from 33 in. to 38 in. on the 30-ft. poles.

The poles were concreted on June 6, 7 and 9 and were tested on July 30 and 31, having set about fifty-four days. The poles were set in refilled ground and not only yielded rather easily in places during the test, but in one or two instances, probably because of dampness, the concrete did not seem to have set well.

The test was made by making a direct horizontal pull 32 ft. above ground on the 40-ft. poles and 23 ft. above ground on the 30-ft. poles, the deflection for every 100-lb. pull being registered.

Nickel-Iron Cell for Light Vehicles

The battery illustrated herewith has been developed for use with electric pleasure cars, 1000-lb. delivery wagons, industrial and baggage trucks and similar vehicles. It is of the nickel-iron alkaline type and is rated at 187.5 amp-hr. It is claimed that the battery is not injured by occasional high rates of discharge, and that the driver may draw any



FIVE EDISON CELLS IN TRAY

amount of current from the battery in emergencies without injury. The battery may be left "on charge" indefinitely, and may even be charged in the reverse direction without harm. The container, grids, poles, etc., are made of steel, and it is said to be practically impossible to damage any part of the cell by falls, jars or collisions. This battery has been placed on the market by the Edison Storage Battery Company, Orange, N. J.

"Golden Glow" Automobile Head-Lamp

Perhaps no theory which has been advanced up to the present time in the illuminating engineering field is of as much practical significance as the one advanced by the Esterline Company, of Indianapolis, Ind., and which is applied in the so-called "Golden Glow" head-lamp recently developed by that company. According to statistics, a considerable portion of the automobile, electric-railway and steam-railroad accidents can be traced directly to the blinding glare of dazzling head-lamps. In fact, such accidents have become so prevalent in Chicago that the City Council has been forced recently to amend an ordinance passed on June 23, 1913, so that it is unlawful to use a head-lamp having a condensing lens or a parabolic reflector without toning down the glare by some means. This ordinance does not prohibit the use of intensifying reflectors, but it does regulate their use in the city streets. Similar ordinances are in effect in New York, Philadelphia and London, and the advent of a new type of reflector which does not cut down the penetrative effect of the rays, and still eliminates the glare or dazzle, is of utmost importance at this time.

In the cities where these ordinances are in effect users of the silvered-glass intensifying reflectors and condensing lenses have been compelled to put a screen over the front of the reflector, thereby reducing the efficiency of the outfit. Several methods of meeting this ordinance have been devised, such as rubbing soap on the glass, closing the front of the reflector, using a translucent glass, or dropping a thin silk screen over the front of the reflector.

The non-dazzling quality of the "Golden Glow" reflector is accounted for by the greenish-yellow glass of which the reflector is composed. This glass absorbs the light waves having a higher frequency than the green. By eliminating these rays, it is asserted that the penetrative power of the yellow rays is surprisingly increased in fogs. It is claimed that the light from the head-lamp, although possessing great illuminating and penetrating power under all atmospheric conditions, is free from glare. The reflectors are parabolic in shape and are provided with an opening at the back in which the base of the incandescent lamp can be inserted and screwed into its receptacle. Eliminating glare by cutting out the higher frequency rays seems more logical than accomplishing the same result with screens which produce internal reflection.

Electric Washing Machine with Novel Reversing Device and Safety Attachment

An electric washing machine is about to be placed on the market by the Conlon Electric Washer Company, of Chicago, which embodies many new features in the way of gear drive, reversing device and safety attachments. The reversing device is especially interesting because of its applicability to other machinery. These machines are made in three sizes suitable for washing six, nine and twelve sheets and are equipped with electric motors rated at 1/6 hp, ⅓ hp and ¼ hp respectively. All of the washers are equipped with electrically driven wringing attachments, one being shown in Fig. 1.

FIG. 1—ELECTRIC WASHING MACHINE

The tub containing the horizontally supported cylinder is mounted on malleable-iron legs, those on one end of the tub forming a framework on which the electric motor and gear drive are mounted. The motor is supported with its shaft horizontal and drives a worm which meshes with a bronze worm-gear attached to a vertical shaft. The worm and its meshing gear are inclosed in a cast-iron housing

which is filled with grease. The vertical shaft extends up through a sleeve supporting a bevel gear and terminates in a control box located on a level with the top of the washing machine within convenient reach of the operator's hand. Communicating with the interior of the control box are two levers, one of which operates the clutch driving the wash-

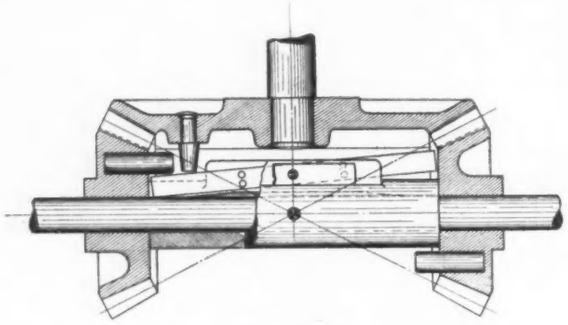


FIG. 2—CROSS-SECTION OF REVERSING MECHANISM

ing machine cylinder and the other operates a clutch driving the wringer, which is of the two-roll reversible type.

The bevel gear which is supported on the sleeve on the vertical shaft runs free except when the washing machine clutch is closed, at which time it revolves integrally with it, driving a horizontal shaft on which are mounted two small bevel gears which mesh with a larger bevel gear opposite

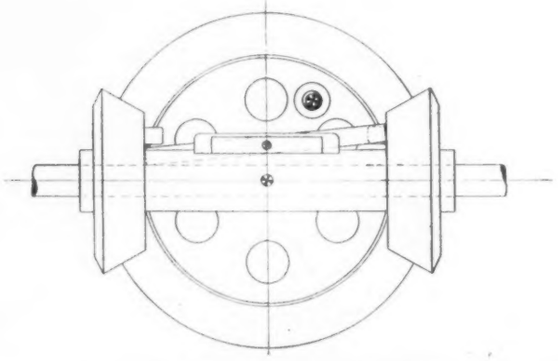


FIG. 3—AUTOMATIC REVERSING MECHANISM

to its diameter, as shown in Fig. 2, and both of the two small gears run free on the horizontal shaft and are at all times in mesh with the larger bevel gear driving the washing-machine cylinder.

Secured permanently to the horizontal shaft between the two smaller bevel gears is a collar. Pivoted to it midway between the small gears is a square rod of hardened steel,

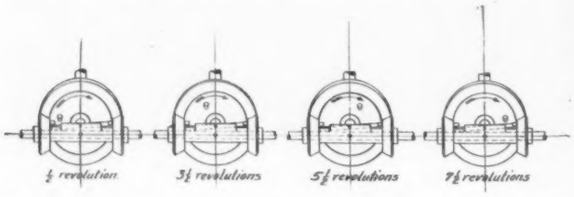


FIG. 4—REVERSING PIN SET FOR VARIOUS REVOLUTIONS OF CYLINDER

which revolves with the collar and tilts in the plane of the shaft (similar to the "walking beam" on a Mississippi River steamboat). Protruding from the face of the disk bearing the large bevel gear is a steel pin which tilts the "walking beam," after a certain number of revolutions of the gear, causing either end of it to engage alternately with one of the small bevel gears. By locking the small pinions alternately with the shaft, the reversing operation of the cylinder is accomplished without the use of a complex arrangement of gears and clutches.

With any given gear ratio in the reversing device, the pin which tilts the rocker arm can be arranged to allow a different number of rotations of the cylinder before it is reversed. Several different views of the reversing device are shown in Fig. 4 with the pin placed in different positions to allow different numbers of rotations before reversal occurs. The entire gear train between the motor and the cylinder is arranged to give a speed reduction of forty to one. To avoid injuring the motor and prevent tearing anything up which might accidentally become caught between the cylinder and the tub of the washing machine, a slip clutch is interposed between the motor and the shaft driving the cylinder.

No innovations are embodied in the driving mechanism between the vertical shaft and the wringer, except that a minimum number of parts are used, but a safety device is attached to the frame of the wringer whereby the rolls may be instantly separated in case the operator's fingers are drawn in between them or should clothing become twisted around the rolls.

Every gear and revolving part is inclosed in an individual housing having a lid which may be raised for inspection, thus obviating any possibility of the operator's hands or clothing being caught in these parts of the apparatus. The motors operating the machines run at 1750 r.p.m. and may be of either the alternating-current or the direct-current type as may be desired by the purchaser.

Cooling Coils for Large High-Tension Transformers

Generators and transformers with a rating of from 14,000 kw to 20,000 kw and operating at a transmission pressure of from 100,000 volts to 150,000 volts cannot be successfully developed in the same way as that in which the 1000-kw units were formerly produced, or with the same machines. It is evident that any emf over 100,000 volts calls for the most dependable construction possible in a transformer.

In a recent California installation the generators feed energy directly through cables and oil switches to four 14,000-

COILING COILS FOR HIGH-TENSION TRANSFORMERS

kw transformers, the cooling pipe coils for which are shown herewith. These coils, which were built by the National Pipe Bending Company, of New Haven, Conn., for the General Electric Company, are 7 ft. 4 in. wide and 22 ft. long and required 15,200 linear ft., or nearly 3 miles, of 1⅜-in. brass tubing.

Electric Fireless Cooker

An electric fireless cooker has been brought out by the Hotpoint Electric Heating Company, of Ontario, Cal., recently, which requires so little current that it can be operated from any electric lamp receptacle. While the cooker operates on the heat-storage system, the lining of the oven is not made of any substance which will absorb a large amount of heat. The insulation is so arranged that valuable time is not consumed in attaining the temperature necessary for cooking.

The "El Cooko," as it is called, measures 17.5 in. wide, 18 in. deep, 22.75 in. high, outside measurements; 9.5 in. wide, 10 in. deep and 12 in. high, inside measurements. The outside casing of the cooker is of blued steel with nickeled corners, legs and handles. The lining consists of one piece

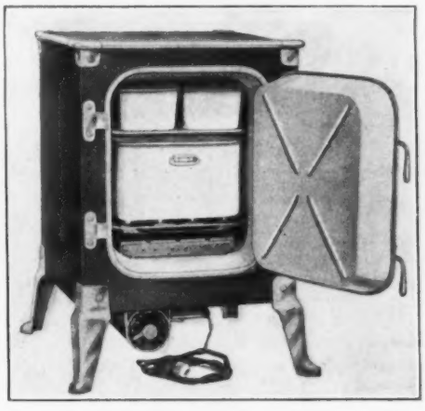
COST OF ELECTRIC AND GAS COOKING

Cost of 5 lb. beef roasted in El Cooko:	
First cost of cut, at 20 cents per lb.	$1.00
Shrinkage in weight, ounces	9
Cost of energy, at 10 cents per kw.-hr., cents	9
Cost of 5 lb. beef roasted in a gas oven:	
First cost of cut, at 30 cents per lb.	$1.50
Shrinkage in weight, ounces	22
Cost of gas at $1 per 1000 cu. ft., cents	8

of drawn aluminum without seams or crevices. Between the lining and the casing is a space which is filled with heat-insulating material. On the front of the stove is a door which swings outward having two clamp levers which lock it tightly so that there is very little chance for heat to escape. The door is also aluminum-lined and filled with the same heat-insulating material.

The heater of the cooker consists of four units, made of pressed steel, each containing separate heating elements. The four heating elements are clamped in a pressed-steel frame which is installed in a compartment directly below the cooking pan. With the added radiating surface, which is obtained by dividing the heater into four units, it is asserted that the time required to bring the oven to a working heat is considerably reduced below what would be required with the ordinary disk-type heater. In addition, no energy is required to raise the temperature of intervening air spaces or storage plates.

Three aluminum cooking utensils are furnished with the outfit. One is a 7-quart seamless aluminum dish with cover, which can be used for roasts, stews, etc.; the other two are



ELECTRIC FIRELESS COOKER

3-pint pressed aluminum dishes used for cooking vegetables and baking bread, etc. These three dishes can be used at the same time.

On the bottom of the outside of the cooker is a dial which operates a thermostatic temperature control. By means of this dial the maximum temperature at which the oven operates can be regulated, and the energy is automatically shut off as soon as this temperature is attained. This automatic control insures the heating element against any damage from overheating. If desired, the heating element can be used for frying purposes by leaving the oven door open. The oven consumes 600 watts, or about as much power as an ordinary electric flatiron.

According to a recent test which was made by the manufacturer of this fireless cooker, it required 1 cent more to cook a 5-lb. roast of beef in the cooker than it would in a gas oven, but the elimination of shrinkage occasioned by the use of the electric cooker more than offset the extra cost of energy. The results of this test are shown in the accompanying table.

Electric Coal Truck

In the accompanying illustrations are shown a 3.5-ton electric coal truck built by the Couple-Gear Freight Wheel Company, Grand Rapids, Mich., for the Blackstone Valley Gas & Electric Company, Pawtucket, R. I. On account of peculiar basement conditions, the truck has been built

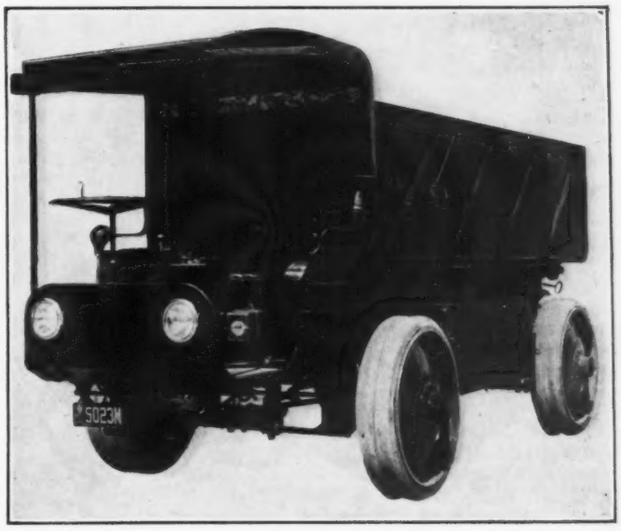


FIG. 1—ELECTRIC COAL TRUCK

with a low height and arranged for making sharp turns It can be turned completely around in a street 24 ft. in width without manipulating the steering gear when once

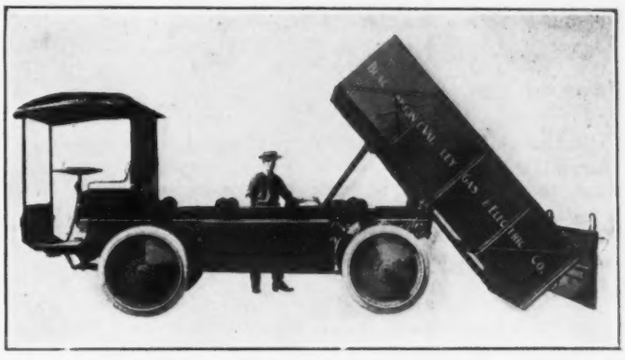


FIG. 2—TRUCK IN DUMPING POSITION

set at the proper angle. All four wheels are used for driving and steering. The equipment is arranged for a speed of from 5 to 10 miles per hour.

This truck is equipped with nickel-iron alkaline cells manufactured by the Edison Storage Battery Company, of Orange, N. J.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Electric Drive Equipment for a Pennsylvania Factory.—Electric drive is to be installed in the factory of the Summerill Tubing Company, at Bridgeport, Pa., also crane equipment, in connection with some changes now in progress, aiming at an increase in capacity of the plant.

New Factory for the Diehl Manufacturing Company.—On Aug. 11 ground was broken for the new factory building of the Diehl Manufacturing Company, at Elizabeth, N. J. The building is to be three stories in height, on a ground area of 60 ft. by 300 ft. The Turner Construction Company, of 11 Broadway, New York, is doing the construction work, which is expected to be completed on Dec. 1.

Supply Trade Conditions in Richmond.—Robinson, Nelson & Company, of Richmond, Va., state that business with them continues very good, considering the fact that money is tight. Their collections have improved considerably in the last week or ten days, however, and the outlook is much brighter, they think, than it has been for the past sixty days. They hope that by the middle of September business will have reached its normal condition.

Lamp Colors Survive Severe Test.—Information comes from C. E. Franche & Company, of 440 Orleans Street, Chicago, to the effect that their Cefco weather-proof lamp coloring has just completed a year's test out-doors, on roof signs, and that the coloring is still intact, has not faded to any noticeable extent, and has not chipped, peeled or cracked. They claim that this system produces lasting and brilliant effects, and that it is economical as well.

Sales of Small Turbines.—The Kerr Turbine Company, of Wellsville, N. Y., recently sold a 500-kw Economy turbo-alternator unit for installation in the municipal lighting plant at Concord, Mass. The Owl Creek Coal Company, of Gebo, Wyo., bought a 200-kw direct-current turbo-generator set, and a mixed-pressure geared turbine was sold to the Columbia Plate Glass Company, of Blairsville, Pa. This last-mentioned machine is to drive a 300-kw slow-speed direct-current generator.

Business in Three-Wire Generators.—The C & C Electric & Manufacturing Company, of Garwood, N. J., states that its type G three-wire generator, with external balancing coil, has had a good sale lately for direct connection to steam and gas engine drive. Its line of motors from 1-hp to 7½-hp rating, of the two-pole commutating-pole type (which was developed to meet a growing demand for a small high-speed motor for centrifugal pump and similar service) is also experiencing a heavy demand.

Electrical Novelty Company to Locate in New York.—The Beacon Miniature Electric Company will have its offices, salesrooms and plant at 108-110 Duane Street, New York, and expects to be in full operation by Sept. 1. It will make a specialty of manufacturing novelty batteries, flash-lamps, bulbs, auto-lamps and electrical novelties of various kinds. Bernard Tauber is president of the company and Ludwig Gaertner is its secretary. Both have been previously interested in similiar enterprises in managerial capacities.

Change in Conduit Prices.—An announcement was made on Aug. 15 by M. B. Austin & Company, of Chicago, Ill., to the effect that on and after that date an advance of 1 point (2½ per cent) would be made in the price of "galvaduct" and "loricated" conduits on deliveries from Chicago stock, no change being made in factory prices on which the card prices recently issued were based. Chicago prices are secured by lowering the Pittsburgh basing discount one point. Thus if the correct discount from factory is 60 per cent the Chicago discount would be 60 per cent less 2.1 per cent for l. c. l. freight and one point for stock delivery, making the f.o.b. Chicago discount 55.4 per cent. To secure delivered price at some point outside of Chicago, but based on Chicago shipment, further freight deduction would be made from the Chicago price. For instance, assuming that the freight from Chicago to destination is 20 cents per 100 lb., there would be deducted an additional two points, making the delivered discount on shipment from Chicago stock 50.4 per cent.

Public Utility Companies Add to Their Electrical Equipment.—The Willapa Harbor Electric Company, of Raymond, Wash., Great Falls (Mont.) Power Company, Adirondack Electric Power Corporation, Glens Falls, N. Y., and Mark S. Wilder, of Watertown, N. Y., are some of the public-utility interests which have lately placed large orders with the General Electric Company for generating and auxiliary electrical equipment. The apparatus purchased includes turbo-generator units, transformers, switchboards and accessories.

Flanders Electric Cars to Be Put Out Under a New Name.—E. LeRoy Pelletier, of Detroit, has purchased from Harris Brothers & Company, receivers, one of the plants of the Flanders Manufacturing Company at Pontiac, Mich., and has organized the Tiffany Electric Company to continue the manufacture of the Flanders electric car under the name of the "Tiffany de Luxe" and the "Tiffany Mignon." Associated with Mr. Pelletier in the venture are many well-known business men of Detroit who are stockholders in the five-hundred-thousand-dollar company being incorporated.

Cooper Hewitt Quartz Lamps Give Satisfaction.—In response to a recent inquiry concerning the electrical equipment of its new plant, the Pittsburgh (Pa.) Screw & Bolt Company sends the following letter: "We have probably one of the largest plants in this country using motor drive. We are thoroughly equipped with power apparatus and our lighting system is the most effective that we have seen, consisting of a series of Cooper Hewitt quartz lamps so arranged and spaced that at night our shop is lighted almost as well as in the daytime." The Economy Fuse & Manufacturing Company recently sold a large order of fuses for the above plant.

Allis-Chalmers Manufacturing Company to Move Chicago Plant.—According to a statement made recently by President O. H. Falk of the Allis-Chalmers Manufacturing Company of Milwaukee, Wis., the company has decided to move its Chicago plant to Milwaukee, the change being made gradually so as to avoid interfering with the regular progress of business and probably covering a period of several months. The following statement was made by President Falk in this connection: "The large contracts now taken by the company comprise machinery made at different plants, and the cost of assembly and shipment of such contracts is necessarily larger than if they were built in one place."

The American Engine & Electric Company, Bound Brook, N. J., has taken over the business of the American Engine Company and will have increased facilities for the manufacture of the American-Ball high-speed steam engines, which have been built by the latter company for the past seventeen years, as well as a complete line of electric motors and generators from the designs of Mr. W. T. Hensley, who is now associated with the company. The officers of the American Engine & Electric Company are as follows: Mr. Hugh C. Pierce, president and treasurer; Mr. William T. Hensley, vice-president and secretary; Mr. F. O. Ball, general manager, and Mr. F. H. Ball, consulting engineer.

Copper-Wire History.—Of historical interest are some figures given out recently on the copper-wire industry in this country in 1909. In that year there were seven mills in the United States drawing copper wire exclusively and the State of New Jersey led in production with 63,452 tons, or 43.1 per cent of the total. The manufacture of insulated wire and cable to the value of $9,806,989 was reported by the above-mentioned plants, and the total value of these products manufactured during that year was $51,624,737 including the product of establishments devoted entirely to this line.

Westinghouse Sales to Public Utility Companies.—Recent heavy purchasers of generating and drive equipment, rotary converters, motor-generator sets, transformers and switchboard apparatus made by the Westinghouse Electric & Manufacturing Company have been the Dayton (Ohio) Power & Light Company, Boston (Mass.) Elevated Railway Company, Marquette City (Mich.) & Presque Isle Railway Company, Interborough Rapid Transit Company of New York, Los Angeles (Cal.) Gas & Electric Corporation and the Merchants' Power Company, of Memphis, Tenn.

Wagner Transformers Installed.—The Manufacturers' Railway Company, of St. Louis, Mo., is building a new roundhouse at the present time, the work being under the supervision of G. E. Wells. About 300 hp of connected load, including energy used for both lighting and power purposes, will be gained from this development by the Union Electric Light & Power Company, of the same city. Three 50-kw and one 25-kw, three-phase, 25-cycle transformers have been installed on this job, all of them of the Wagner Electric Manufacturing Company's make. The Guarantee Electrical Company, of St. Louis, is the contractor.

Virginia Motor Manufacturer on Trade Conditions.—From the Richmond Electric Works, of Richmond, Va., the following letter on trade conditions in that section of the country is received: "Business continues very good with us; in fact, our plant is extremely busy, last month being the largest, from the standpoint of production, that we have ever had. At the same time, we find collections particularly bad not only among the small people but also among some of the largest to whom we sell. Regarding new contracts our work consists at this time of a large number of small orders, although we have outstanding at present a number of large inquiries."

Oklahoma Mine Telephone Equipment.—To the Western Electric Company, of Chicago, Ill., has been awarded the contract for supplying 800 of its standard mine telephone sets for use in the mines of the Oklahoma Coal Operators' Association. This order is stated to be the largest ever placed with this company at one time for such equipment, and it follows the passage of a law by the Oklahoma Legislature making it compulsory for mine operators in that State to provide telephonic intercommunicating systems in their mines. Incidentally, it is expected that these installations will mark a long step toward increased efficiency of operation in each case by putting the executives in constant touch with every part of the mine.

Russian Field for American Machinery.—At the close of a dinner tendered recently in Brooklyn, N. Y., to a delegation of Russians just completing a tour of the United States, Dr. Albert A. Snowden, editor of *American Industries,* made a short speech on the importance of the Russian export field, from which the following abstract is taken: "American exports to Russia have about doubled within a single year. The products shipped there are mainly along the line of machinery, particularly agricultural implements, automobiles, typewriters and electrical apparatus. Russia has vast agricultural resources. Her cereals and dairy products are exported in large quantities to the neighboring states of Europe. The greatest migration to the farms—the most noteworthy 'back-to-the-land' movement of the twentieth century—is the colonization of the black-soil wheat district of Siberia. During each of several successive years more than 500,000 colonists have settled upon the fertile Siberian farm lands. This vast army of farmers is now adopting the most modern methods and modern machinery for developing these farms."

Cooperage Plans to Install Electric Drive.—The J. Schwarzwalder & Son Company, a Louisville (Ky.) cooperage concern, has announced plans for the use of electric drive in a new plant shortly to be put under construction. It has a steam plant and generating equipment, and motors will be purchased in the near future. The installation is of considerable interest because the use of electricity in cooper shops is decidedly unusual, practically all of the plants in the central part of the country using the mechanical system exclusively. Arthur B. Herb is general manager of the company and will be in charge of equipment purchases.

Interborough Rapid Transit Makes Large Purchase of Generating Equipment.—Orders have been placed recently with the Westinghouse interests of East Pittsburgh, Pa., for a large amount of generating equipment for use by the Interborough Rapid Transit Company of New York. In addition to the three 30,000-kw double-unit, steam turbine-driven sets ordered from the Westinghouse Machine Company for use in the Seventy-fourth Street station, there has been placed an order for two 300-kw, 250-volt compound-wound direct-current generators to be driven by steam turbines through reduction gears. This latter order was placed with the Westinghouse Electric & Manufacturing Company.

Connecticut Incandescent Lamp Manufacturer Enlarges Plant.—The Franklin Electric Manufacturing Company, of Hartford, Conn., continuing its policy of expansion to meet the growth of its business, has purchased two large factories in Middletown, Conn., and will shortly move its present plants at Pittsburgh, Pa., and at Newark, N. J., into the new quarters, adding to them the plant already located in Middletown as soon as its present lease expires. Some repairs will be necessary before the new premises can be occupied, and the alterations will include the addition of two stories to the existing buildings. It is expected that the new plant will begin operations on or about Jan. 1.

Pittsburgh Utility Places Big Boiler Order.—The Duquesne Light Company, of Pittsburgh, Pa., has recently ordered from the Babcock & Wilcox Company, of 85 Liberty Street, New York, 16,440 hp of boiler equipment with auxiliary superheaters. Other utility companies that have recently bought equipment of the same make are the Muncie (Ind.) Electric Light Company, the Central Heating Company, of Detroit, Mich., and the Piedmont Railway & Electric Company, Burlington, N. C. The largest recent industrial buyer was the George W. Blabon Company, of Philadelphia, Pa. Over 26,000 hp in boiler equipment and auxiliaries is represented in the latest report on Babcock & Wilcox sales.

Bruce-Macbeth Gas Engines Sold.—The following orders for its vertical multi-cylinder gas engines have been received recently by the Bruce-Macbeth Engine Company, of Cleveland, Ohio: Two 100-hp four-cylinder engines for the Snow Steam Pump Works, for installation in their Louisiana plant; one 60-hp twin-cylinder engine for the American Glove Company, of Dunkirk, N. Y., and one 150-hp engine for the Interstate Cotton Oil Refining Company, at Sherman, Tex. Among recent shipments of this type of engine were one of 150-hp rating for the Fry Glass Company, Rochester, Pa.; one of the same size for John Eichleay, Jr., Pittsburgh, Pa., and a 350-hp unit for the Suydenham Glass Company, of Canada.

Electric Typewriter Concern Plans Factory in Springfield, Mass.—On condition that a reasonable amount of its stock be subscribed for by the financial and business interests of the city and vicinity, the Crawley Power Driven Typewriter & Adding Machine Company, which has headquarters at present at 185 Madison Avenue, New York, proposes to build a large plant for the manufacture of its product at some favorable location in Springfield, Mass. This company was incorporated under the laws of the State of Delaware with a capital stock of $5,000,000, all of it common having a par value of $10. It controls the patents and manufacturing rights on the Crawley electrically operated typewriter, a description of which appeared in the July 5 issue of the *Electrical World.* The Board of Trade of Springfield has taken the company's offer under advisement and is investigating the possibility of making the necessary arrangements to secure the new industry for that city.

St. Louis Plant of the Busch-Sulzer Brothers Diesel Engine Company.—The Busch-Sulzer Brothers Diesel Engine Company has recently completed construction work on its St. Louis plant (consisting of six buildings), and at the present time the electric equipment is being installed. Three 160-kw direct-current, three-wire generators of Crocker-Wheeler make are being put in and about 300 hp in. motors as well as extensive lighting apparatus. The contracting work is being done by the Guarantee Electrical Company, St. Louis.

New Minnesota Lamp Factory.—Work is under way for the new incandescent-lamp factory to be located midway between Minneapolis and St. Paul. It will be known as the Minnesota Mazda Lamp Works of the National Quality Lamp Division of the General Electric Company. Fostoria tungsten lamps will be made here, and it is said that when completed the factory will be able to turn out about 20,000 lamps a day, furnishing employment to nearly 1000 hands. The building will consist of three stories and a basement. It will be of reinforced-concrete construction, with large and numerous window openings. The property comprises over five acres of land, railroad spurs running direct to the plant. An assembly room, restaurants, rest rooms and a gymnasium will be features of the welfare-work equipment. It is expected that lamps will be delivered from this factory in about a year.

Electric Welding of Water-Tube Boiler Headers.—The Electric Welding Company, of 220 West Forty-second Street, New York, recently completed an interesting piece of work in connection with the Worthington water-tube sectional steam boilers, manufactured by James Beggs & Company, of 36 Warren Street, New York. These boilers are compact in construction and therefore particularly adapted to marine work. The headers are made from rectangular charcoal-iron tubes, drawn in long pieces and cut to correct length. It was in closing the end of these tubes that arc welding was employed. Rectangular plates, of proper size to fit into the ends of the square header tubes, were stamped from sheet metal and welded into these tube ends. Samples of tubes thus welded were subjected to a pressure of 2000 lb. per sq. in., and in every case the pipes bulged out of shape before the flat-welded heads gave way. This company is prepared to do electrical welding of all kinds and on parts of any size. It specializes on repair of broken ship parts and on boiler work, but can handle railway and industrial welding work as well.

Electrical Equipment for a Korean High-Tension Installation.—From G. A. Harris, chief engineer for Takata & Company, of 50 Church Street, New York, large exporters of mechanical and electrical equipment to Japan and other Eastern countries, it was learned that at present a very heavy export movement is in progress in generating-station apparatus and auxiliaries as well as in other electrical lines. A big shipment of such nature is to be made shortly to the Seoul Mining Company, in Korea, for equipping its generating station at Pyeng Yang and its substations at Sokutari, Tul Mi Chung and Hol Kol. The Westinghouse Electric & Manufacturing Company is supplying the generating and auxiliary electrical equipment, which includes two 1250-kva, three-phase, 60-cycle, 2200-2400-volt steam-turbine generator sets, each with a direct-connected exciter; two Westinghouse-Leblanc motor-driven surface condensers, step-up, step-down and distributing transformers, electrolytic lightning arresters and switchboards for the central station and substations. Six Heine water-tube boilers of 225-hp capacity each are to be installed, together with two Knowles feed pumps and two Wainwright vertical feed-water heaters. The storage battery is to be furnished by a German manufacturer.

Change in Brooklyn Edison Directorate.—At a meeting of the board of directors of the Edison Electric Illuminating Company of Brooklyn on Aug. 18, Mr. N. F. Brady was elected president to succeed the late Anthony N. Brady, and Mr. J. C. Brady was elected a director and vice-president to succeed Mr. N. F. Brady.

Pacific Coast Utility Doing Good Business.—During the six months ended June 30 the Pacific Gas & Electric Company earned a surplus over interest charges amounting to $1,561,331, a sum sufficient to meet a half year's 6 per cent dividend on the $10,000,000 outstanding preferred stock and 3.94 per cent on the $31,998,750 common stock outstanding. The company is doing at the present time the largest business of its history. It is also making very heavy expenditures on improvement work and extensions of its generating capacity. There is under construction a large reservoir which, when completed, will supply an ultimate capacity of 153,000 hp in six developments.

Westinghouse Earnings Increase During July.—The net earnings of the Westinghouse Electric & Manufacturing Company during July were in the neighborhood of $500,000, bringing the total for the first four months of the company's fiscal year up to approximately $2,400,000. Present indications point to even a larger net for the month of August, but it is not expected that the flood of business enjoyed during the first part of the year will continue throughout the whole year. The foreign subsidiary companies are in a strong financial position. A dividend is expected in a short time for the stockholders of the British company, and the Italian company is also in a good position, having done considerable work during the past year for the Italian government.

Large Utility Holding Company in Prosperous Condition.—The annual meeting of the American Public Utilities Company was held in Grand Rapids, Mich., on Aug. 18, and the annual report rendered showed the company to be in a prosperous condition. An increase in the board of directors was considered necessary because of the steady growth of the company's business, and accordingly the number was raised from seven to sixteen, thirteen of whom were elected, with power to select the remaining three. No action was taken toward increasing the dividend rate on common stock, although the company's earnings would warrant such action. It was decided best to turn the surplus into improvements. The old officers of the company were re-elected as follows: C. B. Kelsey, president; J. H. Brewer, vice-president and general manager; Blain Gavitt, secretary, and W. H. Snow, treasurer.

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Aug. 13	Aug. 20
Allis-Chalmers, t.r., 5th pd	$19,800,000	.....	.....	8½*	9¾
Allis-Chal., pf.,t.r.,5th pd..	16,050,000	.....	.....	16½*	20
Amalgamated Copper.....	153,887,900	1½	Q	74¾	74
American Tel. & Tel.....	344,471,400	2	Q	129½	130½
Electric Storage Battery,c.	16,074,425	1	Q	48	47¾
General Electric.....	101,363,600	2	Q	142½	145½
Mackay Cos., c.....	41,380,400	1½	Q	89*	86
Mackay Cos., pf.....	50,000,000	1	Q	67*	67
Western Union Tel.....	99,747,600	¾	Q	68	67½
Westinghouse, E. & M., c.	34,496,400	1	Q	68	72
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	114*	119½

*Last price quoted.

NEW YORK METAL MARKET PRICES

	Aug. 12 Bid.	Aug. 12 Asked.	Aug. 18 Bid.	Aug. 18 Asked.
Copper:				
Standard, spot*	14.72½ to 15.85		.....	.....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	69 0 0		69 15 0	
Prime Lake	15.75	to 15.87½	.....	16.00
Electrolytic	.....	15.75	15.85	to 15.95
Casting	.....	15.50	15.70	to 15.80
Copper wire base	16.75	to 17.00	16.75	to 17.00
Lead	4.50		4.75	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter	7.50		7.75	
Spelter, spot	.....	5.75	.....	5.87½
Tin, spot*	41.75	to 42.00	41.40	to 41.65
Aluminum:				
Prompt delivery	22.75	to 23.25	22.50	to 23.00
Future	21.00	to 22.00	20.00	to 21.00

*OLD METALS

Heavy copper and wire	14.50	14.50
Brass, heavy	9.25	9.25
Brass, light	8.25	8.25
Lead, heavy	4.40	4.40
Zinc, scrap	4.62½	4.62½

*COPPER EXPORTS

Total tons to Aug. 19..... 22,008

*From daily transactions on the New York Metal Exchange.

Business Notes

George Bender, dealer in second-hand dynamos, motors and machine tools, is removing his plant from 82-84 Centre Street to 122-130 Centre Street, New York. This makes Mr. Bender's fourth move in the past fifteen years, each time to larger quarters. He is equipping his plant with three 18-ft. span cranes and a trolley system for convenience in handling and overhauling his goods.

The Chelton Electric Company, of 314 Armat Street, Philadelphia, Pa., manufacturer of electrical specialties, has appointed G. M. Cox & Company, of 1156 Monadnock Block, as its representatives in Chicago and immediate vicinity. The latter concern is in a position to furnish literature and quotations, and carries a consigned stock on hand from which deliveries can be made.

New Industrial Companies

The Pacific Storage Battery Company, of Los Angeles, Cal., has been incorporated with a capital stock of $10,000 by J. B. Chase, W. P. Chase, R. P. Morgan and others.

The Electric Welding Studding Company, of San Francisco, Cal., has been incorporated with a capital stock of $25,000 by H. K. Eells, E. T. Cooper and C. T. White.

The Zamak Control Company, of Chicago, Ill., has been granted a charter with a capital stock of $100,000 to manufacture electrical supplies. The incorporators are: N. B. Cole, H. J. Locke and G. H. Grant.

The Electrical Supply Company, of Tulsa, Okla., has been incorporated with a capital stock of $2,500 to deal in electrical supplies. The incorporators are: H. K. Herbst, R. J. Johnson and W. H. Stueve, of Muskogee,, Okla.

The J. T. H. Company, of Chicago Heights, Ill., has been incorporated with a capital stock of $5,000 to manufacture and sell electrical and mechanical patents and inventions. The incorporators are: Joseph Sekavec, Hugh Kennedy and John T. Hume.

The Dommers-Walters Electric Company, of Canton, Ohio, has been incorporated by Ray H. Walters, John Dommers, August Dommers, V. P. Meese and H. L. Graber. The company is capitalized at $5,000 and proposes to do an electrical engineering and contracting business.

Trade Publications

Magnetos.—The "Comet" magneto is the subject of a folder recently issued by the Wesco Supply Company, St. Louis, Mo. The folder gives details of construction and a number of ilustrations.

Sectional Switch Boxes.—Much information relating to the construction and installation of various types of sectional switch boxes is given in a folder being distributed by the Chicago Fuse Manufacturing Company, Chicago, Ill.

Outdoor Substations.—The Delta-Star Electric Company, 618 West Jackson Boulevard, Chicago, issues a technical bulletin entitled "Outdoor Substations," which gives a detailed description of high-tension outdoor low-cost substations.

Lighting Fixtures.—The F. W. Wakefield Brass Company, Vermilion, Ohio, is sending out advertising matter relating to its patent ceiling attachment, which eliminates the danger of marring expensive decorations when the fixture is installed.

Pamphlet on Light.—"Correct Practice in Control of Light" is the title of a pamphlet recently issued by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, which contains a discussion on the origin and development of indirect lighting, by Augustus D. Curtis.

Electric Supplies.—The Columbia Electrical Company, electrical supplies, 280 Frederick Avenue, St. Joseph, Mo., continues its progressive advertising policy. Its latest appeal to the prospective customer is in the form of a folder referring to its electrical heaters, their comforts and conveniences.

Fixtures.—Colonial prism fixtures are described in a booklet of twelve pages recently issued by the F. W. Wakefield Brass Company, Vermilion, Ohio. These fixtures may be had with Wakefield receptacle complete, ready for wiring. The receptacles and holders are also illustrated in the pamphlet.

Oil Switches.—Bulletin A-4139, issued by the General Electric Company, is devoted to central-station oil switches of high rupturing capacity. The switches are made both automatic and non-automatic and for voltages from 15,000 to 70,000. The bulletin also contains a list of central stations in which these switches are in use.

Lamp Dimmers.—The Wirt Company, Germantown, Pa., has issued a booklet entitled "The Dim-a-Lite Mother Goose," which contains some striking nursery rhymes relating to its device for varying the light from incandescent electric lamps. The booklets are arranged to carry the imprints of the lighting companies distributing them to their customers.

Oil Separators.—These form the subject of Section "C" of the Cochrane separator catalog, issued by the Harrison Safety Boiler Works, 3159 North Seventeenth Street, Philadelphia, Pa. The introduction to this pamphlet contains interesting information regarding the removal of cylinder oil from exhaust steam, and the pamphlet also discusses various applications of separators and the manner of using them.

Locomotives.—The Baldwin Locomotive Works, Philadelphia, Pa., have printed as Record No. 73, a paper which appeared in the *Journal of the Franklin Institute*, entitled "The Recent Development of the Locomotive," by the consulting engineer of the company, George R. Henderson. Of much interest is the section devoted to the electric propulsion of locomotives. The general subject is comprehensively treated, and a number of illustrations are given.

Slide Rule.—The Roylance electrical slide rule is fully described in a leaflet printed by the Keuffel & Esser Company, Hoboken, N. J., which makes this device. Complete directions for its use are given. By means of a series of scales the different properties of copper wire, such as size, conductivity, weight, etc. may be determined without the use of tables. Scales showing the carrying capacity of different kinds and sizes of wire are placed in the groove in the body of the rule beneath the slide. Other features are the improved runner and the special gauge mark for the conversion of horse-powers and kilowatts.

Centrifugal Pumps.—An artistic and dignified pamphlet is the new eighty-two-page catalog on centrifugal pumps just issued by the Platt Iron Works Company, of Dayton, Ohio. The booklet is well bound, printed in large, clear type, on a good grade of paper, and profusely illustrated. At the same time it is devoted to a straightforward exposition of Platt pumps, without any of the "frills" so common to present-day pamphlets, which serve often to distract the mind from the subject of principal importance. This book gives a summary of the different services to which Platt pumps are adaptable and, following that, a description of the various styles of pumps made for these different uses. Instructions for the estimating and erection of pumps are also given, and at the end of the catalog there are included several useful hydraulic tables.

Small Alternating-Current Motors.—Motors for alternating-current, both single-phase and polyphase, ranging from 0.125 hp to 7.5 hp, are briefly described in Pocket Catalog No. 11, issued by the Advance Electric Company, of St. Louis. These motors are built in two general forms designated as S (short) and W (wound). Form W has an extended end-plate on one end to accommodate a commutator or collector ring. Single-phase motors, both constant-speed and variable-speed, and wound-rotor polyphase motors are furnished in this form. Form S has both end-plates short and is used for motors having a squirrel-cage rotor. Polyphase squirrel-cage motors are furnished in this form. The booklet contains a drawing showing the short-circuiting device of the single-phase, constant-speed motors, with dimensions, prices and other necessary information in relation to all types. The company will furnish a copy of this condensed catalog to any person interested in the sale of electric motors.

Personal Mention

Dr. Peter Cooper Hewitt was a passenger on board the steamship *Olympic* returning to New York from Liverpool Aug. 20.

Mr. L. W. McLellan has been appointed new-business manager for the United Gas & Electric Company, of New Albany, Ind.

Mr. Thomas B. Rhodes has been appointed general manager of the Consumers' Electric Light & Power Company, New Orleans, La. Mr. Rhodes was formerly commercial manager for the Elmira Water, Light & Railroad Company, Elmira, N. Y.

Mr. G. B. Taylor, of Petersburg, Ind., has been appointed electrical expert for the Indiana Public Service Commission. Mr. Taylor is a graduate of Indiana University and for the last five years has been engaged in consulting engineering work in Petersburg and Winslow.

Mr. T. Commerford Martin, secretary of the National Electric Light Association, was tendered a dinner at the Hotel Dempsey, Macon, Ga., Aug. 14, by the officers and executive committee of the Southeastern Section of the association, whose convention was in session at Macon Aug. 14 to 16.

Mr. F. M. Caldwell has been appointed general commercial agent of the gas and electric properties in Michigan operated by Messrs. Hodenpyl, Hardy & Company. Mr. Caldwell will establish headquarters at Detroit, and the new industrial department of which he will have charge will devote its attention to a study of the industrial conditions prevailing in the cities fed from the circuits of the Commonwealth Power, Railway & Light Company, with which Messrs. Hodenpyl, Hardy & Company are also affiliated.

Mr. C. Herbert Sanderson, formerly connected with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., has been appointed electrical engineer of the Havana (Cuba) Electric Railway, Light & Power Company. Mr. Sanderson is a graduate of the Ohio State University and has just completed twelve years of service with the Westinghouse Electric & Manufacturing Company. Part of this time was spent in the switchboard and power station division of the engineering department and part with the general engineering department.

Mr. A. E. Grant has succeeded his brother, Mr. Lawford Grant, as managing director of the Canadian British Insulated Company, Ltd., Montreal. Mr. A. E. Grant has had a wide experience as a marine, mechanical and electrical engineer and has supervised some extensive contracts. His first position as an electrical engineer was with the Notting Hill (London, England) Electric Light Company, for which he erected some three-phase machinery, the second of its kind used in the British Isles. Subsequently he joined the engineering staff of the British Insulated & Helsby Cables, Ltd., of England, which has a large interest in the Canadian British Insulated Company. During his fourteen years' connection with the British company, Mr. A. E. Grant had charge of important work, including the complete equipment of the Chesterfield tramways, and also the laying of extra high-tension mains of the Metropolitan tramways. In 1906 he was appointed manager and chief engineer of the Cardiff office, which takes care of the company's business in south Wales and the southwest district of England. He went direct from Cardiff, Wales, to Montreal and has taken over the duties of Mr. Lawford Grant, who resigned to accept an important position with the Eugene F. Phillips Electrical Works, Ltd., of Montreal.

Mr. R. P. Stevens has resigned as president and general manager of the Lehigh Valley Transit Company, Allentown, Pa., which operates about 150 miles of electric railway from Philadelphia to Allentown, Bethlehem, Nazareth, Slatington and points in the Lehigh Valley, and three electric light plants, the company being a consolidation of nine electric companies. Mr. Stevens was born in Eastport, Maine, on April 3, 1877. He was graduated from the University of Maine with the degree of bachelor of mechanical engineering and electrical engineering, and took post-graduate work in the Massachusetts Institute of Technology. For a time he worked for the Electrical Wiring & Supply Company in Boston, and later took the student's course of the American Bell Telephone Company. He then went with the General Electric Company and assisted in building a number of electric-light plants in the South. Because of fever he left the South and accepted a position with the Automatic Fire Alarm Company of Boston. Later he invented an apparatus for automatic fire alarms and was appointed superintendent of the Western department, with headquarters at Chicago. In February, 1900, Mr. Stevens went to Everett, Wash., to rehabilitate the system of the Everett Railway & Electric Company, of which he later became general superintendent. He supervised the construction of the interurban line and the electrification of the tracks of the Northern Pacific Railway from Everett to Snohomish under an agreement with the Northern Pacific Railway. Mr. Stevens left Everett to accept the position of general superintendent of the Auburn & Syracuse Electric Railroad in Auburn, N. Y. He was later appointed general superintendent of the Auburn & Northern Electric Railroad and general manager of the Skaneateles Lake Transportation Company and manager of the Interurban Electric Express Company. He was elected president of the Lehigh Valley Transit Company in July, 1907. Mr. Stevens has been selected as president of the Mahoning & Shenango Railway & Light Company and its subsidiaries, effective Oct. 1.

Mr. William G. Bee, who has been associated with Mr. Edison for the past eleven years, has been elected vice-president and general sales manager of the Edison Storage Battery Company of Orange, N. J. Mr. Bee first entered the electric vehicle field in 1897, when he joined the forces of the Pope Manufacturing Company of Hartford, Conn. He served with the colors during the war with Spain and returned to the Pope Manufacturing Company, afterward the Electric Vehicle Company of Hartford, spending a year in Mexico in its interests. It was while he was with the Pope company that Mr. Bee came in contact with Mr. Edison, and since the perfection of the Edison storage battery Mr. Bee has directed the sales policy of the Edison Storage Battery Company. Mr. Bee is well known in the automobile industry, and his promotion is a substantial recognition of his long and faithful work for the company.

WILLIAM G. BEE

Obituary

James R. Wiley, of Chicago, Western manager of the Standard Underground Cable Company, died of pneumonia in the Washington Park Hospital, Chicago, Aug. 17. Mr. Wiley was one of the most popular and best known of the electric men of Chicago and also was one of the telephone pioneers. He was born in Newark, Mo., May 1, 1847, and spent his early manhood in St. Louis, graduating from the St. Louis City University. He engaged in mercantile and banking pursuits and became an expert accountant. In 1878 he entered the service of the Metropolitan Telephone & Telegraph Company of New York City and remained with that company and its successors until 1895, when he became affiliated with the Standard Underground Cable Company and removed to Chicago as Western manager, a position he filled until the time of his death. In his eighteen years' residence in Chicago Mr. Wiley acquired a wide acquaintance among electrical men. He possessed a winning personality. The funeral was held in Chicago on Aug. 19. The deceased was unmarried. He was a member of the Jovian order and of the Chicago Association of Commerce. He is survived by three brothers and two sisters. One brother, Mr. George L. Wiley, is Eastern manager of the Standard Underground Cable Company at New York.

Construction

New England

BARTON, VT.—A three-phase, 2200-volt transmission line from the municipal electric-light plant to the granite quarries, 3 miles out, has just been completed. It is also expected soon to contract with other parties who have opened new quarries and also to furnish electrical service to farmers along the route. Hazen Clerke is chief electrician.

MERRIMAC, MASS.—The managers of the municipal electric-light plant expect to purchase 300 incandescent lamps within the next two months. W. A. Bailey is manager.

NORTH ATTLEBORO, MASS.—Within the next two months the managers of the municipal electric-light plant expect to erect 1¼ miles of 2300-volt distribution line (No. 0 cable) to supply energy to the jewelry factory of J. F. Sturdy, Sons & Co. in Attleboro. William Plattner is engineer.

PEABODY, MASS.—The damage to the municipal plant by the fire was much exaggerated, the loss being under $20,000, instead of $40,000 as reported in the issue of Aug. 16. Not much of the work will be subject to contract, except the building repairs, which will be handled through F. W. Dean, Inc., Boston, Mass. Warren D. King is manager of the municipal plant.

SPRINGFIELD, MASS.—Bids will be received at the office of the commanding officer, Springfield Armory, Springfield, Mass., until Sept. 5 for furnishing one worm-gear direct-connected motor-driven elevator. Further information may be obtained by addressing the commanding officer, referring to proposal No. 12.

SPRINGFIELD, MASS.—The Board of Supervisors has decided to install magnetite-arc lamps on Bridge Street, which later will be extended to other side streets in the business district. Main Street will continue to be lighted by the present style of arc lamps, to be attached to trolley poles. William E. Hodges is deputy superintendent of street lighting.

WAKEFIELD, MASS.—The Wakefield Municipal Commission is considering securing energy from the municipal electric plant at Reading to operate the municipal electric-lighting system here.

WESTFIELD, MASS.—A special town meeting will soon be held to determine what action the town will take regarding the proposition of the Amherst Pwr. Co. to enter Westfield. Two propositions will be submitted to the voters. One will ask for an appropriation to erect a transmission line to the outskirts of the town to connect with the line of the Amherst company and the other will call for an appropriation of $25,000 to improve the municipal electric-light plant.

PROVIDENCE, R. I.—Plans have been completed by the City Council committee on lights for extending the installation of the new street lamps in the down-town district into the principal residential sections, including Angell and Waterman Streets and a number of other streets.

Middle Atlantic

ALBANY, N. Y.—Bids will be received by the purchasing committee for state hospitals, Room 138, Capitol, Albany, until Sept. 3 for furnishing the New York State Hospitals for the Insane with incandescent lamps for such a period as indicated on the specifications, deliveries beginning Oct. 1, 1913. For further information apply to the purchasing committee.

AUBURN, N. Y.—The Public Service Commission has granted the Empire Gas & El. Co., of Auburn, permission to issue capital stock to the amount of $400,000, the proceeds to be used for the purpose of acquiring the capital stock of the Central New York Gas & El. Co., of Geneva.

BABYLON, N. Y.—The Babylon R. R. Co. has applied to the Town Board of Babylon for a franchise to furnish electricity for lamps. The company, which now secures energy from the Babylon El. Lt. Co., proposes to build a power plant to furnish power for the railway and to the general public.

BROOKLYN, N. Y.—Bids will be received by the president of the borough of Brooklyn, Room 2, Borough Hall, Brooklyn, until Aug. 27 for electric work required in making alterations at various offices in the borough hall. Plans, forms and further information may be obtained and plans and drawings may be seen at the office of the Bureau of Public Buildings and Offices, Room 29, Municipal Building. Lewis H. Pounds is president.

BROOKLYN, N. Y.—Bids will be received by the commissioner of water supply, gas and electricity, Department of Water Supply, Gas and Electricity, Room 1903, 13 to 21 Park Row, borough of Manhattan, New York, until Aug. 28 as follows: (1) For dismantling and transporting one pumping engine and appurtenances from the New Lots pumping station No. 1 to the New Lots pumping station No. 2, and re-erecting it with piping and other appurtenances complete. (2) For remodeling and extending the buildings at the North Portland Avenue repair yard, No. 98 North Portland Avenue: (a) for all mason work, steel and iron work, carpentry work, sheet metal work, roofing, glazing, painting and electrical work; (b) plumbing and gas fitting; (c) steam-heating work. (3) For furnishing and erecting platforms and railings for the Davis & Farnum engines at Ridgewood North Side station, Atlantic Avenue and Logan Street, being contract abandoned by the City Contracting Co. Blank proposal forms, together with copy of contract, including specifications, can be obtained upon application to the office of the department, room 1903, 13 to 21 Park Row, borough of Manhattan. J. W. F. Bennett is deputy and acting commissioner.

CANAJOHARIE, N. Y.—The Montgomery El. Lt. & Pwr. Co. expects to purchase within the next two months two 50-kva, 15,000-220-volt transformers. W. J. Roser is manager.

FORT ANN, N. Y.—The Public Service Commission has granted the application of the Kanes Falls El. Co. to erect a transmission line from its generating station in Kanes Falls, to Washington County, through the towns of Fort Ann and Granville, to the village of Granville.

JAMESTOWN, N. Y.—At an election held Aug. 9 the proposition to issue $40,000 in bonds, to be used for extensions and improvements to the municipal electric-light plant, was carried.

MARCELLUS, N. Y.—The Public Service Commission has authorized the Marcellus Ltg. Co. to issue $10,000 in capital stock, the proceeds to be used to purchase the electric-light plant in Marcellus, now owned by F. W. Knapp, and for improvements to the lighting system.

NEW YORK, N. Y.—Bids will be received by Henry S. Thompson, commissioner of water supply, gas and electricity, Department of Water Supply, Gas and Electricity, Room 1903, 13 to 21 Park Row, borough of Manhattan, New York, until Aug. 28 for installing a pumping plant at Grant City, borough of Richmond, as follows: (1) For furnishing material and making excavations, building foundations and erecting a radial brick smokestack complete at the main pumping station at Grant City. (2) For furnishing and installing a boiler plant complete in main pumping station. (3) For furnishing materials (except such parts as are furnished by the city) and installing a pumping plant complete. (4) For furnishing and installing a generating plant with switchboards, etc., complete in the main pumping station. Blank proposal forms, together with a copy of contract, may be obtained upon application at the office of the department, Room 1903, 13 to 21 Park Row, borough of Manhattan.

ROCHESTER, N. Y.—Arrangements are being made by the Rochester Ry. & Lt. Co. for the installation of 129 additional magnetite-arc lamps on several streets in the city. Thomas H. Yawger is superintendent.

SYRACUSE, N. Y.—The Oswego River Pwr. Transmission Co., of Syracuse, has received authority from the Public Service Commission to erect a transmission line in the town of Schroeppel to furnish electrical service in that town; also to erect a transmission line in the towns of Ira, Cato and Hannibal, Oswego County, to furnish energy for lamps, heaters and motors, and to extend its line from Fairdale south through the towns of Hannibal, Ira and Cato, through the settlements of Hannibal Center and Ira Hall, to the villages of Cato and Meridian.

UTICA, N. Y.—The Utica Gas & El. Co. has been granted permission by the Public Service Commission to extend its lines to Sauquoit and Holland Patent to furnish energy in both villages. The street-lighting system in Sauquoit will consist of 60 lamps. The installation will cost about $4,000 and is nearly completed. The lighting system in Holland will be installed later and will cost about $3,000.

WATERTOWN, N. Y.—The Public Service Commission has authorized the Watertown Lt. & Pwr. Co. to issue $21,311 in capital stock and $60,000 in bonds, to be sold at not less than par, the proceeds to be used to acquire the property of the Dexter El. Lt. & Pwr. Co., of Dexter, and to take over the property, rights and franchises.

ERIE, PA.—The Erie County El. Co. is building an addition to its power plant on West Fourth Street, to be used as a boiler house. The building when completed will provide space for eight Babcock & Wilcox boilers of 500 hp each. The company is also building a reservoir at a cost of $25,000.

JOHNSTOWN, PA.—Plans are being prepared by the Citizens' Lt., Ht. & Pwr. Co., of Johnstown, for placing its wires underground within the fire limits of the city.

LEBANON, PA.—Extensive changes are being made by the American Iron & Steel Co. at its central works to increase its power plant to enable the company to equip more departments for electrical operation, substituting electrically driven machinery for steam-driven machinery. Five more engines will be installed in the power house.

PITTSBURGH, PA.—Bids will be received at the office of the controller of Allegheny County, Pittsburgh, Pa., until Aug. 29 for installing four electric elevators and for making alterations to the four hydraulic elevators in the Allegheny County court house. Plans and specifications can be seen and blanks for bidding obtained at the office of the county engineer, room 38, Court House, Pittsburgh. R. J. Cunningham is county controller.

SCHWENKVILLE, PA.—The City Council is contemplating the installation of an electric-light plant. It is proposed to build a plant with sufficient output to supply electrical service in the towns of Gratersford, Spring Mount and Zieglersville.

LITTLE FALLS, N. J.—Bids will be received by the commissioners of street-lighting district No. 1 for lighting the streets of said district with 41 incandescent lamps of 32 cp. W. A. Lang is clerk.

NEWARK, N. J.—A large addition is to be made to the manufacturing plant of Whitehead & Hoag, to cost about $175,000, and will include a five-story building, 150 ft. by 356 ft., built of reinforced concrete; also a concrete building for power plant, 50 ft. by 60 ft.

ANNAPOLIS, MD.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 26 for furnishing and installing at the naval engineering experiment station, Annapolis, one Diesel engine, one alternating-current generator and one direct-current oil-driven exciter unit. Application for proposal should refer to Schedule 5679. Blank proposals will be furnished upon application to the navy pay office, Baltimore, or to the above bureau. T. J. Cowie is paymaster general, U. S. N.

CAMBRIDGE, MD.—The Cambridge Gas, El. Lt. & Pwr. Co. expects to erect within the next six months a transmission line (18 miles long) and to purchase transformers, etc., for distribution system and also miscellaneous electrical appliances and supplies. Gustave Lobo, 78 Wall Street, New York, N. Y., is secretary and manager.

FROSTBURG, MD.—The Frostburg Illg. & Mfg. Co. expects to erect within the next three months a transmission line 1½ miles long to a neighboring town to furnish electrical service; also to purchase within the next six months one small direct-connected unit, with a rating of from 50 kva to 75 kva, two-phase, 100 or 2200 volts, and a panel to control small unit. Charles H. Leatham is general manager.

LOGAN, W. VA.—The Logan Land Co., recently incorporated, proposes to deal in real estate, own and operate electric and water plants. The company is capitalized at $50,000. S. A. Draper and F. P. Hurst, of Logan, are among the incorporators.

FREDERICKSBURG, VA.—Arrangements have been made between the Rappahannock El. Lt. & Pwr. Co. and Henry Warden, of the Hazel Hill Canning Co., of Fredericksburg, for the installation of a 125-hp auxiliary steam power plant at the plant of the Hazel Hill company.

WYTHEVILLE, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 30, for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Wytheville. Drawings and specifications may be obtained at the above office or from the custodian of site at Wytheville. O. Wenderoth is supervising architect.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Aug. 29 for furnishing the signal corps with one 2-kw radio set complete for installation on shipboard in accordance with specification No. 566. Motor to operate from 110 volts, direct current. Major W. L. Clarke is disbursing officer.

WASHINGTON, D. C.—An American consul writes that a city in the Levant is to install an electric-light system. The street-lighting system will consist of 500 lamps, of which 200 are to be 50 cp, 150 of 32 cp, and 150 of 16 cp. For further information address No. 11,497, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., Aug. 28 for furnishing 35,000 ft. of cable type 55, in accordance with specifications 431-D, 554-B, to be delivered, in one length coiled, on the Signal Corps cable boat *Joseph Henry* in New York Harbor. Major W. L. Clarke is disbursing officer.

WASHINGTON, D. C.—An American consular officer reports that a business man in his district is prepared to receive propositions for electrical supplies from interested firms in the United States. He confines himself to electrical work exclusively, having under way several contracts among which are the installation of an electrical equipment for a wharf, railroad station, docks, telephone service, etc. He also proposes soon to organize an electrical supply and construction company in the city in which he is located. For further information address No. 11,448, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 2, for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 5758—Miscellaneous ¼-hp multopolar, portable ventilating seats, etc.; one indicating temperature system complete for refrigerator room for U. S. S. *New York;* Schedule 5750—Switchboards for use in operating 35-hp motors. Washington, D. C., Schedule 5746—One automobile ambulance for Naval Hospital, Washington, D. C. Bids will also be received at the same place until Sept. 9 as follows: Mare Island, Cal., Schedule 5741—48,000 lb. electrolyte. Bids will also be received until Sept. 23 for furnishing at Pearl Harbor, Hawaii, the following supplies: Schedule 5733—Miscellaneous lead-covered, paper-insullated cable, miscellaneous lead-covered, rubber-insulated cable, 34,000 ft. fiber conduit, etc., miscellaneous vitrified clay duct in 24-in. and 36-in. lengths, miscellaneous recording watt-hour meters and miscellaneous 60-cycle, 220-volt oil-cooled transformers. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

North Central

CADILLAC, MICH.—Plans have been prepared for the construction of a new power plant for the Cummer-Diggers Co., to cost from $40,000 to $60,000.

MENOMINEE, MICH.—The Menominee & Marinette Lt. & Trac. Co. expects soon to purchase one 200-kw motor-generator set with switchboard to furnish power for street-railway service. Edward Daniell is general manager.

NILES, MICH.—Plans are being considered for the installation of an ornamental street-lighting system in the business district. It is proposed to replace the present arc lamps with tungsten-lamp clusters. The cost of the installation will be paid by the business men.

PETOSKEY, MICH.—Within the next three months the managers of the municipal electric-light plant expect to purchase two Jones underfeed stokers and coal and ash-handling machinery. J. W. Lovelace is manager.

READING, MICH.—The managers of the municipal electric-light plant will erect a new boiler room and coal shed and install two 72-in. by 18-ft. high-pressure horizontal tubular boilers. B. K. Goodman is chief engineer.

REED CITY, MICH.—The Osceola Lt. & Pwr. Co., of Reed City, expects to build a steam auxiliary steam plant and to purchase one 75-kw and one 120-kw, three-phase, 60-cycle generator, one 150-hp engine and one boiler for same. The company was granted a 30-year franchise on Aug. 4. B. J. Stall is secretary and treasurer.

ST. CLAIR, MICH.—The Board of Public Works is contemplating the purchase of recording meters and the erection of a distribution line 1 mile out of the city, using No. 6 wire. The city has just completed the erection of ornamental lamp posts for lighting the park and may erect more ornamental posts this season. W. M. Barron is superintendent.

SAULT STE. MARIE, MICH.—The application of the Edison-Sault El. Co., of Sault Ste. Marie, for the construction of an addition to its power house and for the installation of additional generating machinery has been approved by the War Department. The plans provide for a 58-ft. extension to the present building, the installation of two additional generating units and an exciter unit, together with an entrance for a railroad track from a siding to be put in by the government.

CANTON, OHIO.—Plans are being prepared by Service Director Herbert for lighting the Waterworks Park by electricity. It is proposed to generate electricity at the central pumping station in the park to maintain the lamps.

ORRVILLE, OHIO.—The installation of a municipal electric-light plant, to cost $40,000, is under consideration by the City Council. The proposition to issue bonds for same will be submitted to the voters on Aug. 26. Frank B. Rae, Engineers' Building, Cleveland, is engineer.

TOLEDO, OHIO.—The Willys-Overland Co., of Toledo, it is reported, is planning to install a small motor generator set in its plant.

YOUNGSTOWN, OHIO.—The City Council has passed an ordinance granting Michael Liebel, Jr., for the Youngstown Steam Htg. Co., a franchise to furnish energy for lighting in Youngstown.

BARDSTOWN, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 17, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the Unted States post office at Bardstown, Ky. Drawings and specifications may be obtained from the custodian of site or from the above office. O. Wenderoth is supervising architect.

HOPKINSVILLE, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 29 for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Hopkinsville. Drawings and specifications may be obtained at the above office or from the custodian of site at Hopkinsville. O. Wenderoth is supervising architect.

LOUISVILLE, KY.—Bids will be received by the Commissioner of Fisheries, Washington, D. C., until Sept. 1 for the installation of two electrically driven pumps to be installed at a fish hatchery now being established at Louisville.

OLIVE HILL, KY.—The installation of an electric-light system and ice plant in Olive Hill is reported to be under consideration. Charles Gray and Walter Rankin, of Portsmouth, Ohio, are reported to be interested in the project.

ROCHESTER, IND.—The Rochester El. Lt., Ht. & Pwr. Co. is installing a 375-kva turbine and switchboard, and is erecting a 12-mile transmission line to Argos. The company expects to purchase within the next six months two boilers with a rating of from 200 to 300 hp each, to be equipped complete with stokers and probably coal-handling machinery. C. A. Davis is operating manager.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, 900-910 South Michigan Avenue, Chicago, until Aug. 28 for furnishing the following apparatus: Division A—Round-pattern manhole frames and covers; division 2—Alternating-current synchronous condensing apparatus. All bids must be made upon blank forms of proposals furnished by the Sanitary District of Chicago, which may be obtained at the above office. Thomas A. Smyth, is president of board of trustees.

FARMINGTON, ILL.—The city of Farmington would like to receive estimates on the following apparatus: (1) One single-acting, triple-geared pump with a capacity of 150 gal. per minute against a head of 60 lb. per sq. in., geared to a suitable size, three-phase, 60-cycle motor, to operate at either 220 volts or 2200 volts, and the necessary starting apparatus; (2) an electrically driven centrifugal pump for fire purposes.

to have sufficient capacity to pump water for three lines of 2½-in. fire hose with 1-in. nozzle at a pressure of not more than 75 lb. per sq. in. (estimates to include motor and starting devices); also one 35-hp motor, starting apparatus, jack-shaft, pulleys and bearings, but no belting, suitable to drive an air-compressor, belt wheel of which is 44 in. in diameter with 9-in. face and runs at 140 r.p.m. J. C. Findley is city clerk.

HARVARD, ILL.—The City Council has closed a contract with the Illinois Northern Utilities Co., of Chicago, for lighting the streets of the city for a period of 10 years. The contract calls for 115 lamps in the residence district, 15 arc lamps and 42 ornamental lamp standards in the business district. The property owners are to pay for the installation of the ornamental standards, the city paying for energy and for lamp renewals. The city has also signed a five-year contract with the company for 90 hp in motors to be installed in pumping station.

EAU CLAIRE, WIS.—Bids will be received by John C. Fennessey, city clerk, until Sept. 2 for lighting the city by gas and electricity, specifications for which may be obtained at the office of the city clerk.

MILWAUKEE, WIS.—A resolution favoring the installation of an ornamental street-lighting system on West Water Street between Grand Avenue and State Street and on Second Street between Grand Avenue and West Water Streets has been adopted by the West Water Street Business Men's Association. Ornamental iron pedestals carrying flaming arc lamps will be used. Ninety-seven lamps will be erected on West Water Street and 23 lamps on Second Street. Contract for installing the system will be awarded to the Commonwealth Pwr. Co.

PRAIRIE DU CHIEN, WIS.—The electric plant of the Prairie City El. Co. was recently destroyed by fire, causing a loss of about $8,000.

ANNANDALE, MINN.—The Annandale El. Lt. & Pwr. Co. expects to purchase some incandescent lamps within the next two months. G. G. Sawyer is manager.

BELLE PLAINE, MINN.—The Northern Pwr. Co. expects to erect within the next three months two series street-lighting circuits, one at Wyzatta, and the other at Deephaven, Lake Minnetonka, and to purchase within the next four months one 150-kva, three-phase, 60-cycle, 2300-volt alternator (star-connected) for the Excelsior plant; one 80-hp tubular boiler for the Belle Plaine plant; three distributing panels for 2300 volts with instruments for the Excelsior plant; one generator panel and one distributing panel for Belle Plaine; one tub transformer, one series street-lamp regulator, series street tungsten lamps and equipment. F. L. Rauchwarter is treasurer.

DULUTH, MINN.—Bids will be received by the Great Northern Pwr. Co., of Duluth, Minn., until Sept. 16, for the construction of a storage dam on the Cloquet River, about 20 miles north of Duluth. Plans, specifications, contracts, forms of proposal and further information may be obtained from Gardner S. Williams, consulting engineer, Cornwell Building, Ann Arbor, Mich.

FOLEY, MINN—The Foley El. Lt. & Pwr. Co. expects to purchase within the next year one engine (crude-oil type), directly connected to a 75-kw, 220-volt direct-current generator, with one direct-current generator switchboard panel complete and line material for extending present distribution system. Harmon E. Becker is president and general manager.

GRANITE FALLS, MINN.—The city of Granite Falls has entered into a contract with the village of Wood Lake to furnish energy to operate the proposed electric-light system to be installed there from the municipal electric light plant in Granite Falls. C. Dickerson is superintendent of the municipal electric plant.

KELLIHER, MINN.—The managers of the municipal electric-light plant expect to purchase within the next three months a new boiler. C. B. Kobe is village recorder.

LYLE, MINN.—Extensive improvements are contemplated to the local electric-light plant next summer, including the erection of a new power house. The purchase of an oil engine and poles is also contemplated. N. T. Fortune is manager.

MINNEAPOLIS, MINN.—Bids will be received by George H. Hayes, comptroller of the University of Minnesota, Minneapolis, Minn., until Sept. 8 for the construction of the Educational Building, University of Minnesota, including general contract work, heating and ventilating, plumbing and electrical work in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capital Bank Building, Minneapolis. Bids will be received collectively and separately. Copies of the above may be seen at the Builders' Exchange at St. Paul and Minneapolis, at the office of George H. Hayes, comptroller of University of Minnesota, Minneapolis, and at the office of the State Board of Control, State Capitol Building, St. Paul.

ST. ANTHONY PARK, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until Sept. 2 for construction of the Home Economics Building, University of Minnesota, at St. Anthony Park, including general contract work, heating and ventilating, plumbing and electrical work and fixtures, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capital Bank Building, St. Paul. Bids will be received collectively and separately. Copies of plans and specifications may be seen at the Builders' Exchange in St. Paul and Minneapolis, at the office of the Dean of the University Farm, St. Anthony Park, and at the office of the State Board of Control, State Capitol Building, St. Paul.

ATLANTIC, IA.—The purchase of two 30-kva transformers for the municipal electric-light plant is contemplated. T. E. Nichols is manager.

BURT, IA.—Steps have been taken toward the installation of an electric-light plant in Burt. The Town Council is said to have donated a site for the proposed plant.

DES MOINES, IA.—The Des Moines El. Co. has applied for a franchise in the village of Valley Junction, and if granted the company will extend its lines to that village, purchasing the present system. W. H. Thomson, Jr., is general manager.

FONTANELLE, IA.—Bids will be received by H. J. Stuhlmiller, town clerk, Fontanelle, Ia., until Sept. 3 for furnishing material and construction of substation, overhead distribution system and a transmission line between Fontanelle and Greenfield, 5 1-6 miles in length, and for furnishing meters, transformers, lamps, etc. J. B. Hill, of Iowa City, Ia., is engineer; C. A. Baker is mayor.

FORT MADISON, IA.—At an election held recently the Fort Madison El. Co., controlled by the Stone & Webster Corpn., of Boston, Mass., was granted a 25-year franchise to furnish electricity for lamps and motors in Fort Madison. The company, it is said, will begin work immediately on extensive improvements to the plant.

MONTICELLO, IA.—The capital stock of the Monticello El. Co. has been increased from $48,000 to $60,000.

MOUNT VERNON, IA.—The Wapsie Pwr. & Lt. Co., of Mount Vernon, expects to erect within the next six months a 33,000-volt, three-phase transmission line to Clarence and Lowden (14 miles long), and to purchase within the next six or eight months a five-panel switchboard, one 23,000-volt oil switch and low-tension circuit-breaker, and within the next six months one aluminum-cell arrester (33,000 volts). Kenneth Lindsay is manager.

NEVADA, IA.—The Nevada El. Co. has placed orders for a 150-kva three-phase, 60-cycle alternating-current Westinghouse generator, one 200-hp Bates Corliss engine (heavy duty) and new switchboard fully equipped, including Tirrill voltage regulator, to be installed about Sept. 15. The company also expects to purchase within the next two months one open heater, from 1500 ft. to 2000 ft. of safety cable for electrolier system and 50 five-lamp standards for curb-lighting system.

CAINSVILLE, MO.—The Missouri El. Gas & Wtr. Co, of Cainsville, expects to erect within the next two months ½ mile of distribution line and to purchase within the next three months one new engine, one alternating-current generator and one rotary converter, and also miscellaneous electrical appliances and devices. L. J. Beauregard is superintendent.

CHAFFEE, MO.—At an election held recently the citizens authorized the City Council to enter into a five-year contract with J. J. Astor for street-lighting, provided the said contract is turned over to the Missouri Public Utility Co., of Cape Girardeau, which has agreed to purchase the Astor plant and improve the service. A. M. Tinsley, of Cape Girardeau, is manager of the company.

DEXTER, MO.—Benjamin F. Eicholtz, owner of the local electric-light plant, expects to purchase within the next 30 days one 125-kw, three-phase, 60-cycle, 2300-volt, 600 to 900 r.p.m. generator (belted), complete switchboard for one 75-kw and one 125-kw generator and outgoing lines.

PURCELL, MO.—At an election held recently the proposition to grant a franchise to a company (represented by A. M. Baird, of Cartersville) to construct and operate an electric-light plant in Purcell was carried.

RUSSELLVILLE, MO.—Petitions have been presented to the City Council, asking that an election be called to submit the proposition to establish a municipal electric-light plant in Russellville to a vote.

MOHALL, N. D.—Application has been made to the City Council by George H. Todd, of Minot, for the installation of an electric-light plant in Mohall. The cost of the proposed plant is estimated at $8,000.

RULO, NEB.—Plans are being prepared for the installation of a municipal electric-light plant, for which bonds to the amount of $20,000 have been voted. C. I. Stocking, of Hiawatha, Kan., is engineer.

YORK, NEB.—The Continental Gas & El. Co., of York, expects to rebuild its distribution system, changing the system from direct current to alternating current, within the next three months; also to purchase one 250-hp boiler, equipped with automatic stokers, one 300-kw and one 200-kw generator directly connected to cross-compound Corliss engine, complete alternating-current switchboard and generator feeder panel, and two circuits for series street-lighting system. James B. Harvey is general manager.

CANEY, KAN.—The Caney El. Lt. & Pwr. Co. expects to purchase within the next two months one 75-kva, 2200-volt, 60-cycle, three-phase generators, voltmeters and ammeters, poles, cross-arms and wire to rebuild the entire distribution system. The company is now installing a 120-hp Miller gas engine. O. C. Lindsley is manager.

ESBON, KAN.—Plans are being prepared for a municipal electric-light plant and water-works system in Esbon. Henrici, Kent & Lowry, 1526 Grand Avenue, Kansas City, Mo., are consulting engineers.

FORT LEAVENWORTH, KAN.—Bids will be received at the office of the constructing quartermaster until Sept. 5 for construction, including plumbing, heating, wiring and fixtures, of schoolhouse at this post. Blank forms of proposals furnished upon application. Plans, etc., may be seen at Fort Leavenworth and at office of quartermaster, Scarritt Arcade, Kansas City, Mo. Major G. G. Bailey is constructing quartermaster.

MELVERN, KAN.—At a special election held recently the proposition to issue $8,000 in bonds for the purpose of erecting an electrical distribution system was carried. Energy for operating the system will be obtained from Lyndon, 10 miles distant.

ST. GEORGE, KAN.—A company has been organized in St. George for the purpose of furnishing electrical service here and in Zeandale, about 2 miles distant. The company proposes to erect a transmission line to the power plant of the Manhattan City & Interurban Ry. Co. at Rocky Ford to secure energy for distribution in the two towns and to farmers along the line.

TOPEKA, KAN.—The State Board of Control has authorized the installation of electric wiring and lamps at the State Soldiers' Home at Dodge City, the Mother Bickerdyke annex at Ellsworth and the Soldiers' Home at Atchison. Electric fans will be installed in the hospital at the Soldiers' Home.

WELLSVILLE, KAN.—The City Council is considering the question of purchasing the local electric-light plant, owned by E. T. Pendleton and J. H. Hay. If the plant is taken over it is proposed to extend the distribution system into the residence section of the city.

Southern States

NEWBERN, N. C.—The Board of Aldermen has voted to purchase a new arc-lamp machine for the municipal electric-light plant, at a cost of about $3,500. Bids will soon be asked for the machine and also for an electrically driven pump. The new machine will have sufficient output to maintain 100 arc lamps and a number of incandescent lamps. H. H. Hodges is superintendent of the water and light plant.

McDONOUGH, GA.—J. C. McDonough, owner of the local electric-light plant, expects to purchase within the next three months a street-lighting system complete; also pipe insulation for entire plant.

STATESBORO, GA.—The managers of the municipal electric-light plant and water-works system expect to purchase within the next four months one 150-hp return tubular boiler (150 lb. working pressure). Daniel L. Gould is superintendent.

TALLAPOOSA, GA.—At an election to be held Sept. 13 the proposition to issue bonds to provide funds for the installation of an additional generating unit and for extension to distribution system will be submitted to the voters.

WHIGHAM, GA.—The installation of a municipal electric-light plant is under consideration, for which, it is understood, bonds have been voted.

TARPON SPRINGS, FLA.—The Southern Utilities Corpn., Heard National Bank Building, Jacksonville, it is reported, will make improvements to its local electric plant, involving an expenditure of about $25,000.

TULLAHOMA, TENN.—The Tennessee Utilities Co., recently incorporated, expects to build a hydroelectric plant on the Elk River in Franklin County. The capital stock is placed at $25,000, which will be increased for the purpose of development. The present plans provide for a development of 20,000 hp. G. M. Whitson is president and L. E. Womack is secretary, both of Tullahoma.

WHITEVILLE, TENN.—Plans are being considered by Henry Rhodes, of Whiteville, for the installation of an electric-light plant. The proposed plant will furnish energy for street-lighting and for power purposes.

BIRMINGHAM, ALA.—The Birmingham Ry., Lt. & Pwr. Co., it is reported, has entered into a contract with the Alabama Trac., Lt. & Pwr. Co., of Talladega, for hydroelectric power generated at the power plant on the Coosa River at Lock 12, near Birmingham. The contract calls for a minimum supply to the amount of $367,500 per year. The Alabama company has also contracted to furnish energy to two cement plants and other customers, guaranteeing an additional revenue of $200,000 annually.

OPELIKA, ALA.—The city of Opelika expects to purchase within the next six months one 150-kva generator and a Ball engine to drive same. Charles Schaefer is superintendent of light and water plant.

NEW ORLEANS, LA.—The Orleans-Kenner El. Ry. Co., of New Orleans, has announced that all options on terminal property have been obtained and that work will soon begin on construction of the proposed railway which is to extend from a terminal station on University Place to the towns of Shrewsbury, Harahan, Kenner and Hanson City, a distance of from 15 to 20 miles. The cost of the project is estimated at from $500,000 to $700,000. A. Smith Bowman is president and E. F. Ullmer is secretary and treasurer.

WELSH, LA.—At an election to be held Sept. 9 the proposition to issue bonds for the installation of a municipal electric-light plant will be submitted to the voters. L. A. Robinson is chairman of light committee.

MEDFORD, OKLA.—The municipal electric-light plant was destroyed by fire on Aug. 12, causing a loss of about $48,000. The plant, it is understood, will be rebuilt at once. At present the town is without electrical service.

HOUSTON HEIGHTS, TEX.—Plans are being considered by the citizens of Houston Heights for the installation of a municipal electric-light plant and water-works system.

Pacific States

EATONVILLE, WASH.—At an election held recently the proposition to construct a municipal electric-light plant was carried. The proposed plant is to be located on Lynch Creek, near Eatonville.

STEVENSON, WASH.—A final water-power permit has been granted by Acting Secretary of Agriculture Galloway to E. P. Ash and Samuel Samson, of Stevenson, the power to be used in logging operations in the vicinity of Wind River. The water-power project is located on national forest land of the Columbia Forest, about 30 miles northeast of Stevenson. By means of a timber dam about 10 ft. in height water will be diverted into a wood-stave pipe 4 ft. in diameter, in which it will be carried about 1 mile to the power plant, which will be equipped with one 750-kw generator directly connected to a Pelton waterwheel.

WINLOCK, WASH.—The Veness Lumber Co. is contemplating the construction of a 1000-hp electric power plant in Winlock, for which, it is said, plans are practically completed. About 200 hp will be used by the company to operate the machinery in its plant and the remainder will be sold to the Independent El. Co.

ALBANY, ORE.—Plans have been approved by the City Council for the erection of a cluster-lamp lighting system on several streets of the city.

BAKER, ORE.—Plans and specifications for the proposed municipal electric-light plant which is to be built near here have been submitted to the City Commissioners, and if same are approved, bids for construction of plant and erection of transmission lines, etc., will soon be asked.

SALEM, ORE.—In accordance with an act of the last Legislature a committee consisting of State Engineer Lewis and four others has been appointed to make an investigation of the practicability of developing hydroelectric power at Cello Rapids for distribution by the State. An appropriation of $15,000 was made by the Legislature to carry on the work.

BODIE, CAL.—The Pacific Pwr. Co., of Bodie, expects to erect within the next three months 70 miles of high-tension transmission line (55,000 volts) connecting the plant of the Pacific Pwr. Co. with the plants of the Nevada-California Pwr. Co., located on Bishop Creek, Inyo County. W. N. Chatfield is manager.

CALISTOGA, CAL.—The Calistoga El. Co. contemplates the purchase of circuit-breakers, meters, lamps and some electrical appliances and supplies. C. W. Crouch is secretary and manager.

CORONA, CAL.—Within the next 30 days the Corona Gas & El. Co. expects to rebuild its series incandescent street-lighting system. C. C. Barlett is superintendent.

CORONA, CAL.—The Southern Sierras Pwr. Co., of San Bernardino, expects to extend within the next 30 days its 33,000-volt distribution lines into the territory south of Corona to gain a pumping load.

NAPA, CAL.—The Legislature has passed a bill appropriating $15,300 for rewiring (electrical) of building and conduits at the Napa State Hospital.

OCEANSIDE, CAL.—The Oceanside El. & Gas Co. has recently erected a 6600-volt transmission line (8 miles long) into the San Luis Rey Valley to furnish energy for lamps and motors in that district, and has also just installed a 72-in. by 16-ft. Pennsylvania overhead suspension boiler. Eugene V. Griffes is manager.

SAN DIEGO, CAL.—The State Railroad Commission has granted the San Diego Consol. Gas & El. Co. authority to issue $102,000 in bonds.

SANTA CRUZ, CAL.—The city of Santa Cruz expects to install within the next three months through the Coast Counties Gas & El. Co., of Santa Cruz, 50 additional luminous-arc lamps and to erect from 10 miles to 15 miles of line, which will give the city 200 4-amp luminous-arc lamps, the arc-lamp circuit covering about 50 miles throughout the city. Within the next 30 days the city expects to purchase an auxiliary sewage pumping plant, consisting of one 40-hp motor directly connected to a No. 6 open-runner sewage pump, to be used in emergency cases. J. C. Geyer is superintendent of electrical department.

TORRANCE, CAL.—The Torrance Wtr., Lt. & Pwr. Co. has received authority from the State Railroad Commission to issue bonds to the amount of $115,000 and $34,000 in capital stock.

VISALIA, CAL.—The Board of Trustees has entered into a contract with the Mount Whitney Pwr. & El. Co., of Visalia, for street-lighting for a period of five years. The contract provides for 80 luminous arc lamps at $72 each per year. The new system is to be installed by Nov. 1. V. M. Maddock is vice-president.

KOOSKIA, IDAHO.—The Kooskia Milling & Pwr. Co. is erecting a transmission line to Stites, which will be completed in about 30 days, for which all material has been purchased. The company expects to purchase in the near future a waterwheel governor for a 40-in. Sampson turbine. E. J. Hartman is manager.

SAND POINT, IDAHO.—The Northern Idaho & Montana Pwr. Co., of Sand Point, expects to purchase within the next 30 days one 100-kw induction motor-generator set to operate the street-railway system, which heretofore has been operated by a 55-kw outfit. George N. Rooker is manager.

SHOSHONE, IDAHO.—The substation of the Great Shoshone & Twin Falls Lt. & Pwr. Co. in Shoshone was recently destroyed by fire. It is understood that the plant will be rebuilt at once. The main office of the company is located in Twin Falls.

BOUNTIFUL, UTAH.—The Utah Lt. & Ry. Co., of Salt Lake City, is planning to build a power plant at Bountiful to furnish energy to operate the extension of its street-railway system.

PARK CITY, UTAH.—The City Council has granted Lewis A. Jeffs a franchise to construct and operate an electric-light and power plant in Park City for a period of 25 years.

FLAGSTAFF, ARIZ.—The Board of Trustees of the Flagstaff Normal School has awarded the contract for the installation of a complete light, water and heating plant for the school to F. A. Slattery, of Flagstaff, at $34,226. The contract for construction of power house was awarded to Joseph Slosser, of Phoenix, for $4,700.

KINGMAN, ARIZ.—The Desert Wtr. & Pwr. Co., of Kingman, expects to erect next month extensions to its high-tension power lines in the Gold Road and Kingman districts, including the installation of three additional 250-kva Wagner transformers and auxiliaries at Gold Run. Duplex copper-clad wire will be used for that portion of the 45,000-volt line crossing the Gold Road Camp.

DENVER, COL.—Estimates have been submitted by J. J. Abbott, a civil engineer associated with J. I. Carper, of Denver, in what is known as the Fraser Sources Irrigation & Pwr. Co., of the cost of diverting the water from Fraser River and its tributaries in Grand County for domestic and power purposes in Denver. The cost of construction of canal, conduit and reservoir, exclusive of distribution system, is estimated at $3,250,000. The project calls for the construction of collecting canals on each side of the Fraser River, making a junction near the west portal of the proposed Moffat tunnel, costing about $400,000; also the construction of a storage reservoir at the eastern portal of the tunnel at a cost of $1,500,000. The project also includes 200 second-ft. of water dropping down an incline of 4400 ft., which it is estimated will develop 130,000 hp.

PLATTEVILLE, COL.—The Village Board is considering the question of installing an electric-lighting system in Platteville. A proposition has been submitted to the board by the Northern Colorado Pwr. Co., of Boulder.

ELKO, NEV.—Water rights have been secured by California capitalists on the South Fork stream above the Clayton ranch in Elko for the purpose of constructing a hydroelectric power plant. It is estimated that 10,000 hp can be developed and the initial unit installed will be from 3000 hp to 5000 hp. Energy developed at the plant will be transmitted to mining camps at Bullion, Round Mountain and Ely, which will receive the larger portion. Investigations have been made by Leon M. Hall, Kohl Building, San Francisco, consulting engineer.

Canada

INNISFALL, ALTA.—A by-law will be submitted to the ratepayers on Aug. 26 authorizing an expenditure of $6,000 to complete the municipal electric-light plant.

ROGERS PASS, B. C.—Work will soon begin on the construction of the Rogers Pass tunnel, contract for which has been awarded to Foley, Welch & Stewart, of Vancouver. New equipment required to carry out this contract will represent an investment of about $500,000. Separate steam plants will be used on each end of the tunnel.

VANCOUVER, B. C.—The Western Canada Pwr. Co., Carter Cotton Building, Hastings Street, Vancouver, expects to erect within the next 12 months an extension to its present hydroelectric station at Stave Falls, B. C., to provide space for two additional 9000-kw units, making a total of four 9000-kw units. The company also expects to purchase within the next 12 months two 13,000-hp turbines and two 9000-kw, three-phase generators, orders for which have been placed with Escher, Wyss & Co. Contracts have been placed with the Canadian General El. Co. for turbines, for generators and eight 3000-kva, 60,000-volt transformers, and with the Canadian Westinghouse Co. for additional switchboard equipment. R. F. Hayward is general manager.

ERINDALE, ONT.—The Erindale Pwr. Co. has made application to the Toronto Township asking its consent to the raising $50,000 by mortgage on its property. The dam which was carried away by the flood two years ago has not been completely replaced. The company, which has an output of between 400 and 500 hp, will be able to increase the generating capacity of the plant by 500 hp upon completion of the dam. A meeting of the bondholders will be held on Aug. 29 to authorize the company to issue $10,000 in bonds for working capital and general purposes.

FERGUS, ONT.—The Hydro-Electric Power Commission has submitted an estimate to furnish energy in Fergus and Elora.

HAMILTON, ONT.—Tenders will be received by John Allan, Mayor, chairman Hydro-Electric Board, care of city clerk, Hamilton, until Aug. 28 for the installation of a joint underground conduit system for the Hamilton Hydro-Electric system, the Dominion Pwr. Co., the Transmission Co. and the telegraph companies. Plans and specifications can be seen at the office of E. I. Sifton, consulting engineer of the Hydro-Electric Department, where form of tender, specifications and other information can be obtained.

ORILLIA, ONT.—The town of Orillia has petitioned the Ontario government to assist the town in connection with its power plant. The work being done by the Canadian government on the Georgian Bay canal has rendered it necessary to remove the present power plant 1¼ miles farther up the rapids of the river. The Canadian government has consented to erect a new power house and dam at a cost of $25,000, and the Ontario government is being asked to assist the town to secure a right-of-way for its new pole line and to contribute something toward the installation of new machinery made necessary by moving the plant.

SMITH FALLS, ONT.—The Smith Falls El. Pwr. Co. expects to erect within the next three months about 5 miles of new lines for a new three-phase, 60-cycle system to be installed next month and to install within the two months one 275-kw Westinghouse three-phase, 60-cycle, 2220-volt generator; also to purchase within the next two months a hot-water heater having a rating of 350 hp for a 500-hp Goldie & McCullough high-speed auxiliary unit and switchboard apparatus for handling the new generator; also to purchase 200 60-cycle, 5-amp and 10-amp ammeters and to erect about twenty 5-kva and 10-kva transformers within the next four months, and to install from six to twelve new arc lamps. George B. Frost is general manager.

WATFORD, ONT.—The Town Council is considering the installation of a lighting system, energy to maintain same to be supplied by the Hydro-Electric Power Commission of Ontario.

MONTREAL, QUE.—Tenders have been asked for the installation of the second portion of the underground conduit on Catherine Street—from Craig Street to Pine Avenue and between Atwater Avenue and Guy Street.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Sept. 10 for transformers, switchboard, wire and cable, conduit, panelboards and miscellaneous electrical apparatus. Blanks and general information relating to this circular (No. 789) may be obtained at the above office or at the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whiney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

New Incorporations

CHICAGO, ILL.—The Interocean Lt. & Pwr. Co. has been incorporated with a capital stock of $50,000 by Herman H. Kohlsaat, Samuel S. Sherman and D. W. Beardsley. The company proposes to generate and distribute light, heat and power, etc.

OLYMPIAN SPRINGS, KY.—The Olympian Springs Ry., Pwr. & Lt. Co. has been incorporated to construct and operate an electric railway between Olympian Springs and Olympia, a distance of 4 miles. S. F. Crecilius, of Louisville, engineer, has already begun a survey for the proposed railway. J. D. Wilson, of Greensburg, is president. Post Office address Olympian Springs, R. F. D. from Elixir Springs.

PIKEVILLE, KY.—The Sandy Valley Lt. & Pwr. Co. has been incorporated with a capital stock of $20,000 by John M. Hopkins, James G. Serey and L. S. Wilson.

WILLIAMSTOWN, MASS.—The New England General Utilities Co. has been incorporated with a capital stock of $1,000 and the following named officers: H. S. Dickinson, president, and Minnie E. Sherman, treasurer.

SAULT STE. MARIE, MICH.—The Michigan Northern Pwr. Co. has filed articles of incorporation with a capital stock of $3,000,000. The incorporators are: W. D. Gregory, R. L. Benson, E. J. H. Wright, G. H. Moore and A. F. Bordwell, all of Chicago, Ill. The company will maintain watercourses in Chippewa County, in the township of Sault Ste. Marie and within the city limits, and will supply energy for manufacturing purposes.

DULUTH, MINN.—The St. Louis Pwr. Co. has filed articles of incorporation with the Secretary of State with a capital stock of $1,000,000. The company proposes to generate electricity by steam or water-power and distribution of same for lamps, heaters and motors within the State of Minnesota. The incorporators are: J. B. Crane, A. G. Gillette, J. A. Sinclair and Harry Carmichael, all of Duluth.

RICH SQUARE, N. C.—The Rich Square El. Co. has been incorporated with a capital stock of $50,000 to furnish electrical energy to light the town. The incorporators are: M. Bolton, J. T. Bolton, R. B. Boyce and others.

WELLINGTON, TEX.—The Wellington Pwr. & Lt. Co. has been incorporated with a capital stock of $10,000 by D. E. Goodwin, J. S. Goodwin and R. E. Elison.

OLYMPIA, WASH.—The Washington Public Service Co. has been incorporated with a capital stock of $1,500,000 to operate electric railways, etc. The incorporators are: Millard Lemon, W. B. Foshay and others.

MONTGOMERY, W. VA.—The Montgomery Utilities Co. has been chartered with a capital stock of $50,000 for the purpose of operating water-power, electric and gas plants. The incorporators are: J. S. Lilly, Wesley Wilkes, of Beckley, W. Va.; A. A. Lilly, J. E. Brown and A. H. Curry, of Charleston, W. Va.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 12, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York]

1,069,679. ELECTRIC WATER HEATER; H. De Wallace, Syracuse, N. Y., App. filed Sept. 18, 1912. Plurality of electric coils disposed in separate compartments of a common boiler, each surrounded by water and controlled independently.

1,069,695. VAPOR-ELECTRIC APPARATUS; P. C. Hewitt, New York, N. Y. App. filed May 13, 1904. Plurality of negative electrodes and a common positive electrode and a separate work circuit connected with each negative electrode.

1,069,696. STARTING DEVICE FOR VAPOR APPARATUS; P. C. Hewitt, New York, N. Y. App. filed June 4, 1904. The high-potential impulse from a choke-coil starts one of two vapor lamps when the other one goes out.

1,069,697. ELECTRODE HOLDER; G. Hills, Westfield, N. J. App. filed Nov. 26, 1912. Hand-operated clamp for holding an electrode for like purposes.

1,069,707. ARRANGEMENT OF INCANDESCENT FILAMENTS IN ELECTRIC METAL-FILAMENT LAMPS; O. Krause, Berlin, Germany. App. filed Jan. 10, 1910. Two concentrically disposed circles of longitudinally extending filaments.

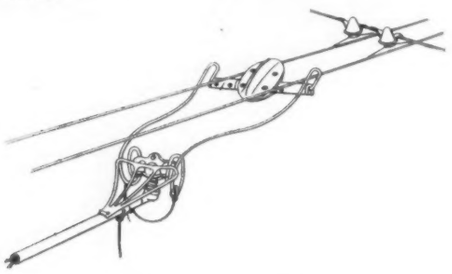
1,069,709. ELECTROMAGNETIC RECIPROCATING MOTOR; A. Le. Blanc, New York, N. Y. App. filed May 18, 1909. Has a number of isolated solenoids with a corresponding number of isolated core pieces, the solenoids being energized all at once.

1,069,777. SWITCH BOX; W. O. Fowler, Wenatchee, Wash. App. filed June 7, 1911. The switch mounting arms are adjustable upon the box to bring the switch flush with the plaster.

1,069,780. DISTRIBUTION SYSTEM; J. H. Hall, Cleveland, Ohio. App. filed Oct. 2, 1911. All the motors in a system are caused to slow down quickly after the opening of a circuit-breaker and indication is given to switchboard attendant that motors have stopped.

1,069,782. ELECTRIC INSULATOR; J. D. Hilliard, Albany, N. Y. App. filed Aug. 11, 1908. For high-tension lines; has a nest of insulator shells detachably held one within another by cement with an embedded wire coil for breaking the cement.

1,069,791. STORAGE CELL; A. C. Krueger, Milwaukee, Wis. App. filed Aug. 1, 1912. Uses antimony electrodes with a saturated hydrochloride acid solution of compounds of antimony and chlorine as the electrolyte.



1,069,887.—Pole System.

1,069,800. HANGER FOR TROLLEY WIRES; W. A. McCallum, Cincinnati, Ohio. App. filed May 19, 1910. Tubular shank with clamp at its upper end engaging messenger cable and clamp at its lower end engaging trolley wire.

1,069,809. STORAGE BATTERY; W. A. Prince, Quincy, Mass. App. filed Feb. 4, 1913. Pasted-grid type; positive grid having two lugs at opposite corners and diagonally extending cross-ribs.

1,069,811. TELEPHONE APPARATUS FOR TRAINS; P. Robinson, Sudbury, Ontario, Canada. App. filed May 13, 1912. Reel on the train carrying supply of wire for temporary connection with telephone line adjacent to the track-way.

1,069,815. CIRCUIT-BREAKER; W. E. Sands, New York, N. Y. App. filed June 30, 1909. Movable member carrying the switch contacts; closely fits the side walls of an inclosing box so that switch is inclosed both in the open-circuit and closed-circuit conditions.

1,069,819. CABLE-END BELL; E. O. Sessions, Chicago, Ill. App. filed Oct. 20, 1910. Coupling and clamping members for excluding moisture and dissipating static electricity.

1,069,820. CABLE-END BELL; E. O. Sessions, Chicago, Ill. App. filed Feb. 9, 1912. The armor of the cable is mechanically and electrically connected to the shell of the end bell.

1,069,877. CONDUIT BOX; F. J. Hurst, Denver, Col. App. filed Oct. 13, 1911. Openings in conduit box are of size of largest conduits, and for smaller-sized conduits reduction plates are used.

1,069,887. POLE SYSTEM; J. Ledwinks, Philadelphia, Pa. App. filed Oct. 27, 1909. Sliding contact for trackless trolleys.

1,069,888. ELECTRICAL TESTING BATTERY; E. Marcuson, New York, N. Y. App. filed July 6, 1912. The unit-battery cells are provided with insulated envelopes containing an insulating oil.

1,069,899. MICROPHONE; G. A. Nussbaum, London, Eng. App. filed May 4, 1912. A compressible rubber ring surrounds the body of carbon granules to permit movement of the granules at right angles to the plane of the sound waves.

1,069,902. ARMATURE; R. H. Pyle, Indianapolis, Ind. App. filed Jan. 11, 1912. Longitudinal movement of the armature upon the shaft is prevented by clamps holding the laminated core.

1,059,922. ELECTROMAGNETIC RECEIVER; T. C. Coykendall, Kingston, N. Y. App. filed Oct. 17, 1907. Feeble current of electricity is received and indicated by an electrical unbalancing of coils.

1,069,924. ELECTRIC FURNACE; W. N. Crafts, Oberlin, Ohio. App. filed Oct. 15, 1912. Induction furnace with bath and U-shaped passageway for molten metal, the bath portion being separable from the supporting body of the furnace.

1,069,938. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; H. F. Goetz, Waterbury, Conn. App. filed Jan. 4, 1913. The screw shell is held in place by the clamping together of the two halves of the porcelain block.

1,069,949. APPARATUS FOR ELECTRICALLY HEATING WATER, AIR OR OTHER MEDIUM BY MEANS OF A HEAT MAGAZINE; C. I. F. Hassler, Stockholm, Sweden. App. filed Dec. 16, 1912. Heat-storage magazine distributing means and means for controlling the amount of heat to be stored and distributed.

1,069,981. METHOD OF RECOVERING COPPER FROM ITS ORES; E. Schaaf, St. Mary's, Mo., and S. G. Martin, Chicago, Ill. App. filed Aug. 27, 1909. Converts copper content of the ore to a solution, charges solution with gaseous peroxide of nitrogen and subjects solution to heat and pressure.

1,609,993. ELECTRICAL PURIFICATION APPARATUS; R. W. Amos, Paterson, N. J. App. filed Oct. 3, 1908. Electrical purification of sewage for killing germs and precipitating the material portions of the substance treated.

1,070,007. ALLOY; A. L. Brooke and R. D. Mackintosh, Mortlake, England. App. filed June 25, 1910. Produces an alloy of aluminum, nickel and magnesium.

1,070,017. ELECTRIC FURNACE; W. N. Crafts, Oberlin, Ohio. App. filed Dec. 4, 1911. Heats the contents by electric induction acting on a fused bath at the base of the shaft, heat from the bath rising in the shaft causing chemical reactions in the contents.

1,070,080. CAR-LIGHTING SYSTEM; H. G. Thompson, Glen Ridge, N. J. App. filed Aug. 22, 1908. Charging generator rendered imperative upon its functions being accomplished and resuming action independently of the speed at which the train is running.

1,070,099. ELECTRIC-LIGHTING SYSTEM; H. Baluss, Kennett Square, Pa. App. filed April 3, 1911. To prevent going out and fluctuation of the lights in a trolley car because of drops in current and to indicate drop in current so that car can be slowed down to accommodate condition of power.

1,070,102. ELECTRIC-CURRENT BRUSH STRUCTURE; A. E. Berdon, Lafayette, Ind. App. filed July 8, 1912. Inter-engaging links limit inward movement of spring-pressed brush-holder to prevent holder from engaging rotating element.

1,070,104. TELEPHONE SYSTEM; G. A. Betulander, Saltsjo-Nacka, Sweden. App. filed Nov. 22, 1910. To prevent loss of current by leakage.

1,070,130. RAILWAY SIGNALING SYSTEM; J. S. Hobson and L. F. Howard, Edgewood Park, Pa. App. filed Jan. 24, 1911. Trolley or third-rail divided into blocks by insulation.

1,070,151. INSULATOR; W. H. Martin, Ukiah, Cal. App. filed March 14, 1912. Vitreous blocks having meshing corrugations and ridges crimp the wire between them.

1,070,172. HANDLE OR BUTTON; J. G. Peterson, Hartford, Conn. App. filed Sept. 22, 1911. For snap switches and the like; the yoke which is molded into the handle is flexible, to contract and expand with the composition of which the handle is made.

1,070,289. TELEGRAPH APPARATUS; A. Rappenecker, Bremen, Germany. App. filed July 8, 1912. Copying apparatus with a ray of light acting as a receiver.

1,070,290. DEVELOPING APPARATUS FOR WRITING-TELEGRAPHS AND THE LIKE; A. Rappenecker, Bremen, Germany. App. filed July 8, 1912. Exposed portion of the receiving film is cut off by gearing operated from the transmitting station.

1,070,291. DEVICE FOR LOCKING DESK TELEPHONES; C. D. Rhinehart, Jr., and L. P. Saponoff, New York, N. Y. App. filed Jan 31, 1913. Two-part clamp with a concealed screw.

1,070,307. SWIVEL JOINT FOR ELECTRIC CONDUCTORS; C. Twining, Locust Point, N. J. App. filed June 29, 1912. Relatively rotatable cord terminals.

1,070,310. INDEX NEEDLE OR HAND FOR USE WITH ELECTRICAL MEASURING INSTRUMENTS; E. Weston, Newark, N. J. App. filed Nov. 9, 1909. Non-vibrating index needle comprising a plurality of diverging and converging spaced members.

1,070,311. INDEX NEEDLE OR HAND FOR USE WITH ELECTRICAL MEASURING INSTRUMENTS; E. Weston, Newark, N. J. App. filed Nov. 9, 1909. Has a balance cross with diverging members and converging members which are flattened together to constitute a pointer top.

1,070,337. ELECTRIC FURNACE; A. E. Greene, Chicago, Ill. App. filed Nov. 12, 1909. Maintains electric arcs in proximity to the material, draws out the arcs to obtain uniform heating, utilizes a gas to react with the material.

1,070,345. APPARATUS FOR OPERATING MERCURY-VAPOR LAMPS; F. H. Von Keller, New York, N. Y. App. filed Aug. 6, 1908. Starting switch and movable exhausted container with portions connected by U-shaped tube.

1,070,370. MULTIPLE NEEDLE HOLDER FOR ELECTROLYSIS; E. K. Willison, Chicago, Ill. App. filed Dec. 15, 1911. Adjustable support for carrying a plurality of needles, particularly instruments for the removal of superfluous hair by electrolysis.

1,070,371. SIGNALING SYSTEM; E. R. Gill, Yonkers, N. Y. App. filed July 27, 1908. Train dispatching messages and independent messages are transmitted by different operators without interference over single-line wire, and train dispatcher at any time may take possession of the line.

1,070,376. MEANS FOR MEASURING OR CONTROLLING THE FREQUENCY OF WAVE-LENGTH OF ALTERNATING CURRENTS; G. Seibt, Schöneberg, Germany. App. filed Aug. 2, 1912. Movable part of the instrument is inductively acted upon by the fields of fixed coils acting in opposite directions.

13,605 (re-issue). ELECTRICAL CONNECTOR; R. H. Welles, Kenosha, Wis. App. filed April 19, 1913. (Original patent No. 1,054,809, March 4, 1913.) Detachable connection for small fixtures such as automobile lamps.